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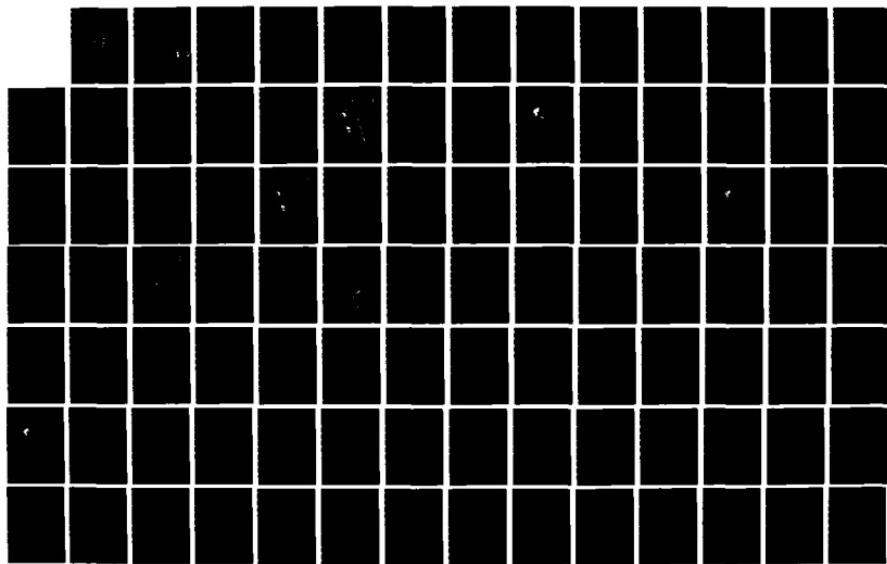
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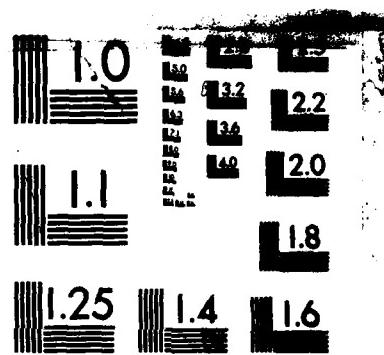
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INSTALLATION RESTORATION PROGRAM PHASE II -- CONFIRMATION/QUANTIFICATION

STAGE 1

FINAL REPORT

FOR

ROBINS AIR FORCE BASE
ROBINS AIR FORCE BASE, GEORGIA 31098

AIR FORCE LOGISTICS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

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JUL 9 1985
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PREPARED FOR

UNITED STATES AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY (OEHL)
BROOKS AIR FORCE BASE, TEXAS 78235

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MARCH 1985

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INSTALLATION RESTORATION PROGRAM
FOR ROBINS AIR FORCE BASE, GEORGIA

PHASE II--CONFIRMATION/QUANTIFICATION
STAGE 1

Prepared for:

UNITED STATES AIR FORCE
Occupational and Environmental Health Laboratory
Aerospace Medical Division
Brooks AFB, Texas

Prepared by:

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March 1985

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Zone 4

Contamination of shallow groundwater within Zone 4 (Landfill No. 1 and the JP-4 Spill site) is indicated by the presence of TOX, phenolics, and cyanides in nearly all monitoring wells. Samples from well LFI-3 had high concentrations of purgeable organics and oil and grease. An estimated 2.3 feet of fuel was present in well LFI-3 prior to initial sampling. Cyanide concentrations in samples from wells LFI-1 and LFI-4 exceed the EPA ambient criterion of 200 ug/l. Results of metals analyses indicated no significant contamination due to cadmium, chromium, copper, lead, nickel, or zinc.

Zone 5

Contamination in shallow groundwater and surface water in Zone 5 (Landfill No. 2 and Fire Training Area No. 1) is indicated by the presence of TOX, purgeable organics, and phenolics in nearly all water samples. Concentrations of specific purgeable organic compounds exceeded EPA ambient water quality criteria in some instances. Cyanide was detected (25 ug/l) in only one sample. Results of metals analyses indicated no significant contamination due to cadmium, chromium, copper, lead, nickel, or zinc.

Zone 6

Zone 6 (Hazardous Waste Burial Site) is probably not a significant threat to human health or the environment. Only a small quantity of wastes was disposed of at Zone 6, and according to the Phase I report, all wastes buried at Zone 6 were encapsulated in concrete before burial. No existing water supply wells on Robins AFB are downgradient of the site.

Water Supply Wells WS-3, WS-6, and WS-8

Total phenolics data for water supply wells WS-3, WS-6, and WS-8 may exceed EPA water quality criteria for specific phenolic compounds. Solvent scans were positive for wells WS-3 and WS-8 in March 1984.

significant is the determination that contaminants at the Sludge Lagoon and at the downgradient edge of Landfill No. 4 have migrated deeper into the aquifer against an upward hydraulic gradient. Data for wells on Hannah Road indicate lower levels of contamination on the basis of analyses for TOX and phenolics.

Zone 2

Groundwater and soils samples from Zone 2 (DDT Spill site) were contaminated by pesticides. Groundwater in the perched water table beneath the site was contaminated by low concentrations of pesticides; however, it is probable that the low concentrations of pesticides in groundwater would be attenuated by soils materials before reaching the closest downgradient water supply well (WS-5), which is approximately 0.5 miles east of the site. Therefore, Zone 2 poses no practical threat to potable water supplies. Soils in the drainage ditch near the site contained very high concentrations of dichlorodiphenyltrichloroethane (DDT) and chlordane. This drainage ditch leads to a drainage way which flows into Duck Lake which is stocked with catfish for recreational fishing.

Zone 3

The water-table aquifer at Zone 3 (Fire Protection Training Area No. 2) is highly contaminated; petroleum products, organic solvents, and lead are the primary contaminants. An oil layer (1.3 feet) was present on the water surface in the shallow well before the December sampling. Groundwater from the next lower (confined) aquifer showed no contamination from oil, solvents, or lead, but it did have a TOX concentration of 70 micrograms of chloride per liter ($\mu\text{g Cl}^-/\text{l}$). The water supply well (WS-12) at the site showed possible contamination by TOX and phenolics. It should be emphasized that WS-12 is used to supply water to Luna Lake and is not used as a source of potable water.

Table S-4. Summary of Results and Recommendations for Phase II, Stage 1 Study Sites, Robins AFB, Georgia (Page 2 of 2)

Study Site	Results	Recommendations
Zone 4 o Landfill No. 1 and JP-4 Spill Site	<ul style="list-style-type: none"> o Confirmed contamination of water-table aquifer by cyanides. Potential contamination by organohalides and fuel was also detected. Fuel was detected in one well which contained high concentrations of volatile aromatics and oil and grease. 	<ul style="list-style-type: none"> o Define extent of JP-4 Spill Site. o Expand monitor well network to better define vertical and horizontal extent of contamination. o Expand analytical parameters to better define nature of contamination.
Zone 5 o Landfill No. 2 and Fire Training Area No. 1	<ul style="list-style-type: none"> o Confirmed contamination of groundwater and surface water by solvents. Potential contamination indicated by phenolics and TOX. 	<ul style="list-style-type: none"> o Expand monitor well network to better define vertical and horizontal extent of contamination. o Expand analytical parameters to better define nature of contamination.
Zone 6 o Hazardous Waste Burial Site	<ul style="list-style-type: none"> o No significant contamination attributable to DDT, PCBs, or mercury. 	<ul style="list-style-type: none"> o No need to continue monitoring the Hazardous Waste Burial site. Incorporate well HM-1 into annual monitoring program for the Low Level Radioactive Waste Disposal site.
Water Supply Wells o WS-3, WS-6, and WS-8	<ul style="list-style-type: none"> o Groundwater from these wells may exceed EPA water quality criteria for specific phenolics compounds. Groundwater from WS-3 exceeded the EPA ambient criterion (0 ug/l) for trichloroethylene. 	<ul style="list-style-type: none"> o Monitor WS-3 in conjunction with continued monitoring of Zones 1, 4, and 5. o Monitor all three wells for phenolics.

Table S-4. Summary of Results and Recommendations for Phase II, Stage 1 Study Sites, Robins AFB, Georgia (Page 1 of 2)

Study Site	Results	Recommendations
Zone 1 o Landfill No. 4 and Sludge Lagoon	<ul style="list-style-type: none"> o Confirmed contamination of groundwater, surface water, and sediments by organic solvents and cyanide. Nonspecific analyses (specific conductance, phenolics, DOC, and TOX) support this finding. o Determined that contaminants are migrating deeper into the aquifer against an upward hydraulic gradient. o Detected lower levels of possible contamination (TOX and phenolics) in groundwater from wells at Hannah Road. 	<ul style="list-style-type: none"> o Expand monitor well network to better define vertical and horizontal extent of contamination. o Expand surface water sampling network. o Expand analytical parameters to better define nature of contamination. o Seal and abandon wells W-2 through W-11 in accordance with Georgia law. o Determine horizontal hydraulic conductivity of aquifer. Use results to better estimate maximum distance groundwater may have travelled since 1965.
Zone 2 o DDT Spill Site	<ul style="list-style-type: none"> o Detected low concentrations of insecticides in the perched water-table aquifer near the site, but they pose no threat to potable water supplies. o Detected moderate to very high concentrations of DDT and chlordane in soils within drainage ditch leading to Duck Lake. 	<ul style="list-style-type: none"> o Monitor samples of fish flesh in Duck Lake for chlordane and DDT.
Zone 3 o Fire Protection Training Area No. 2	<ul style="list-style-type: none"> o Confirmed contamination of water-table aquifer by petroleum products and TOX. o Groundwater from the next lower (confined) aquifer showed no sign of contamination from petroleum products. TOX indicated potential contamination from organohalides. o Groundwater from water supply well WS-12 showed potential contamination attributable to organohalides, phenolics, and solvents. 	<ul style="list-style-type: none"> o Monitor Luna Lake to determine if it has been affected by contamination from WS-12. o Determine nature of apparent organohalide contamination in the confined aquifer. o Monitor the confined aquifer annually to determine if contaminants from the water-table aquifer have migrated through the confining bed.

Table S-3. Schedule of Samples for Phase II, Stage I Study Sites, Robins AFB, Georgia

*Aldrin, DDT isomers, dieldrin, endrin, heptachlor, heptachlor epoxide, lindane, methoxychlor, diazinon, malathion, parathion, 24-D, 4-S-T, and silvex.

The list of analyses for one 2 was subsequently extended to include palladium, platinum, gold, silver, copper, chromium, lead, nickel, and zinc.

* The first
Lindane,
† Lead.
March 19

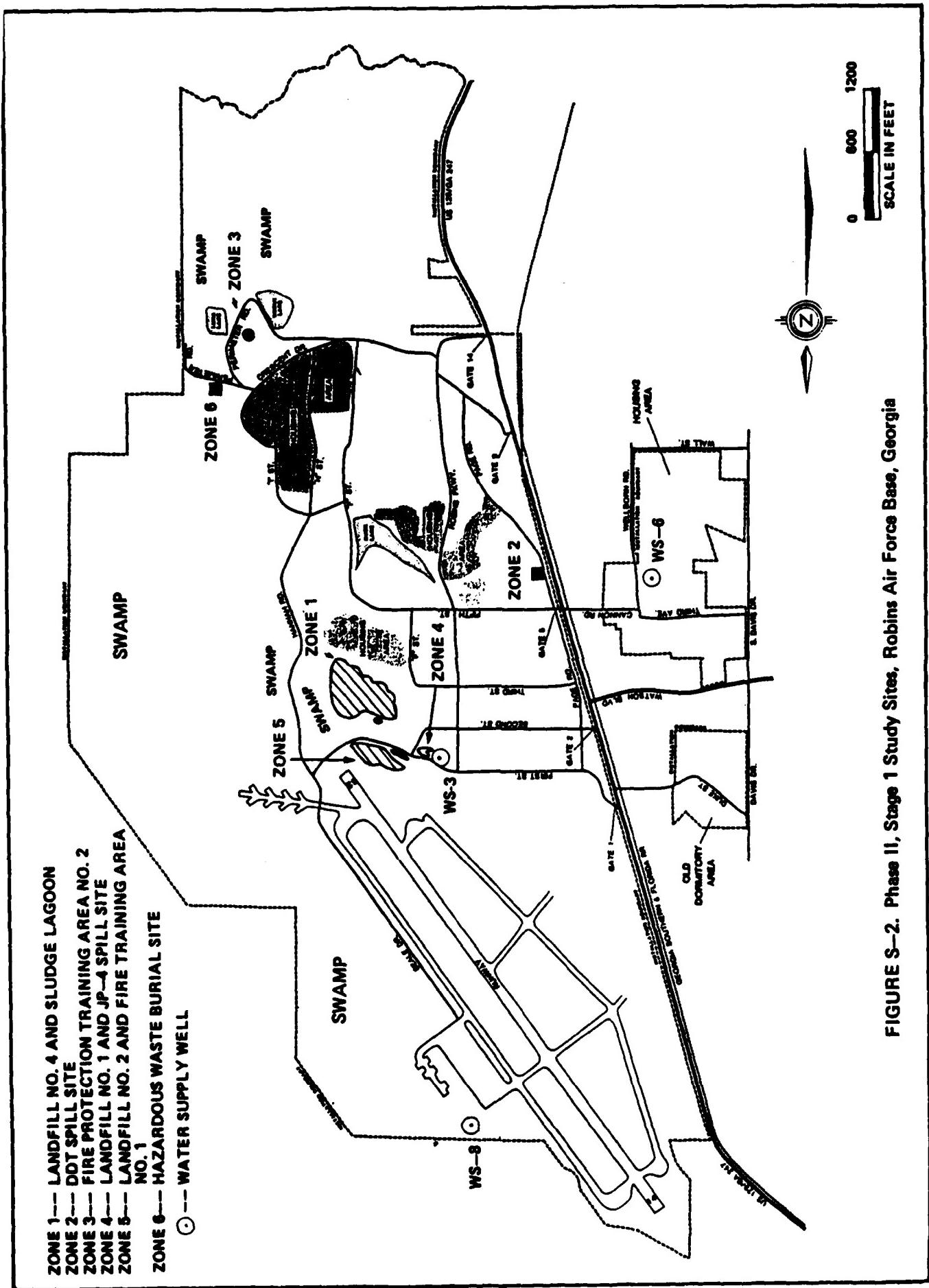


FIGURE S-2. Phase II, Stage 1 Study Sites, Robins Air Force Base, Georgia

SOURCE: Schroeder et al., 1992.

Table S-2. Phase II, Stage 1 Field Evaluation Study Sites at Robins AFB, Georgia (Page 2 of 2)

Site	Period of Operation	Approximate Site Size	Estimated Waste Volume	Suspected Types of Wastes
Zone 5 Landfill No. 2	1951 - 1963	22 acres	580,000 yd ³	General refuse, industrial wastes, boiler ash, malathion (approximately 40 tons 1.5% aggregate).
Fire Training Area No. 1	1943 - 1950s	*	*	Contaminated fuel, oil, solvents, and ignitable chemicals.
Zone 6 Hazardous Waste Burial Site	1976 - 1977	200 ft ²	>15 gal	Approximately 240 aerosol cans of DDT with pyrethrin, mercury-contaminated wastes, and PCB-contaminated wastes. All encased in concrete and buried.

*Data not given in Phase I report.

Source: Schroeder et al., 1982.

Table S-2. Phase II, Stage 1 Field Evaluation Study Sites at Robins AFB, Georgia (Page 1 of 2)

Site	Period of Operation	Approximate Size	Estimated Waste Volume	Suspected Types of Wastes	
Zone 1					
Landfill No. 4	1965 - 1978(79)	45 acres	484,000 yd ³	General refuse, putrescible wastes, hardfill, industrial wastes, approximately 200 55-gallon drums of industrial wastes stored at Landfill No. 4 in 1979.	
Sludge Lagoon	1962 - 1978(79)	*	*	Sludge from industrial waste treatment plant No. 1 (phenols and oils). Sludge from industrial waste treatment plant No. 2 contained cyanide, chromiums, and other heavy metals. Paint removers, solvents, hydraulic fluids, and oils were also disposed of in the sludge lagoon.	
Zone 2 DDT Spill Site	1979	*	55 gal	DDT leaked from a drum in the pesticide storage area.	
Zone 3 Fire Protection Training Area No. 2	1950s - 1960s	*	*	Contaminated fuel, oil, solvents, and ignitable chemicals.	
Zone 4 Landfill No. 1 JP-4 Spill	(1943) 1946 - 1951 mid-1960s	2 acres	65,000 yd ³	General refuse, industrial wastes, boiler ash, and incinerator ash. JP-4 seepage reported for several excavations in the vicinity of Landfill No. 1.	*

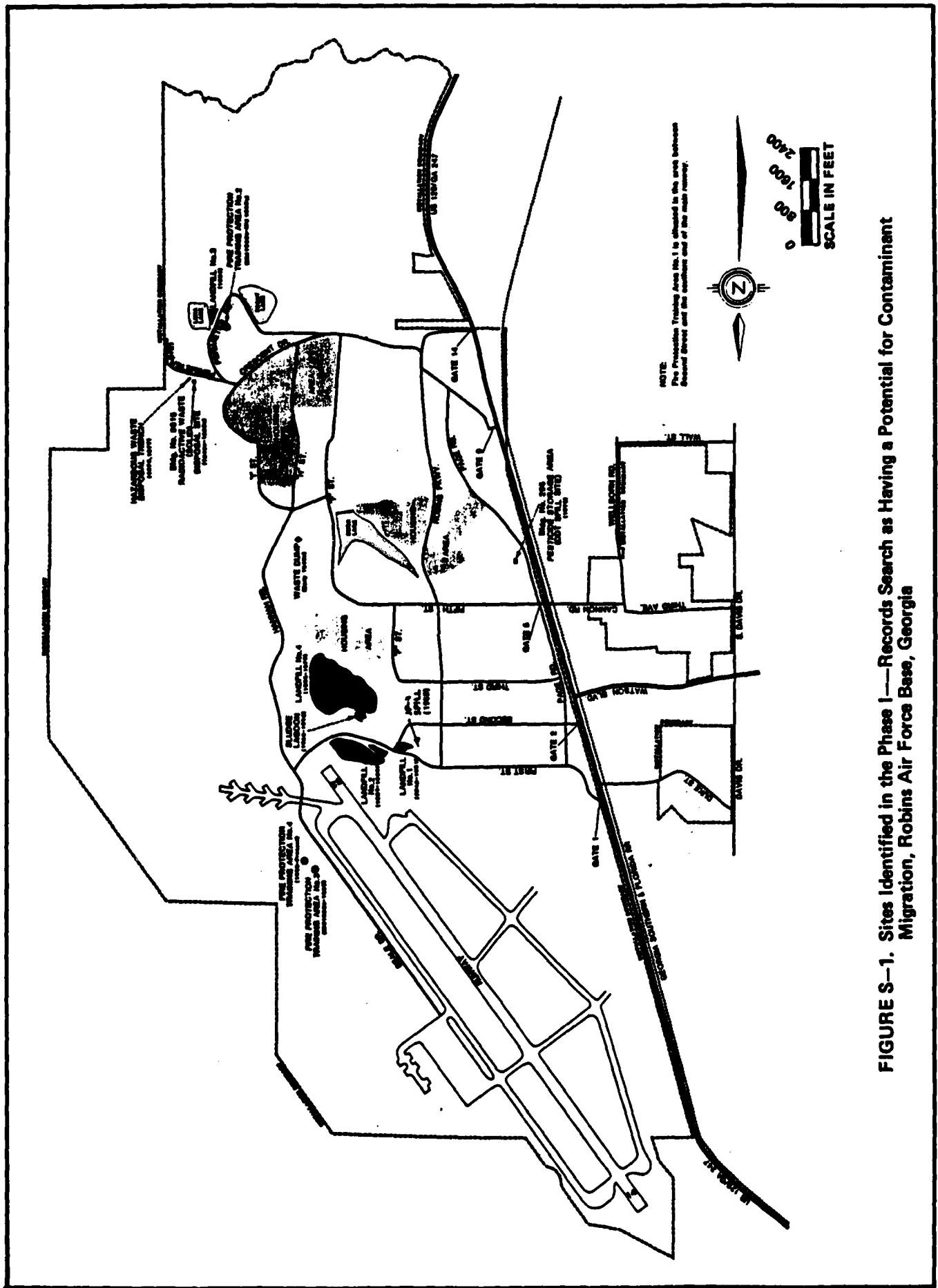


FIGURE S-1. Sites Identified in the Phase I—Records Search as Having a Potential for Contaminant Migration, Robins Air Force Base, Georgia

SOURCE: Schroeder et al., 1982.

Table S-1. Priority Ranking of Potential Contamination Sources at Robins AFB, Georgia as Given in the Phase I--Records Search

Rank*	Site Name	Date of Operation or Occurrence	Overall HARM Score
1†	Sludge Lagoon	1963-1978	77
2†	Landfill No. 4	1965-1978	73
3†	DDT Spill (1979)	1979	70
4†	Fire Protection Training Area No. 2	mid 1950s-mid 1960s	64
5†	Landfill No. 1	1943-1951	59
6†	Landfill No. 2	1951-1953	58
7†	JP-4 Spill (1965)	1965	57
8†	Hazardous Waste Burial Site	1976, 1977	54
9†	Fire Protection Training Area No. 1	1943-mid 1950s	52
10	Laboratory Chemical Disposal Site	early 1960s	52
11	Landfill No. 3	1964	47
12	Fire Protection Training Area No. 3	mid 1960s-1969	45
13	Low Level Radioactive Waste (Solid) Burial Site	1940s-1950s	31

*This ranking was performed according to the Hazardous Assessment Rating Methodology (HARM).

†Phase II, Stage 1 Study Sites.

Source: Schroeder et al., 1982.

SUMMARY

Phase II, Stage 1 Installation Restoration Program (IRP) study sites at Robins Air Force Base (AFB) included three landfills, two fire training areas, one industrial waste sludge lagoon, one DDT spill site, one hazardous waste burial site, one JP-4 spill site, i.e., nine of the 13 sites identified by the Phase I study (See Table S-1 and Figure S-1). Since several of the sites were colocated, the IRP study sites were redefined as six zones (Table S-2, Figure S-2); consequently four zones include pairs of sites. Water supply wells WS-3, WS-6, and WS-8 were included in the Phase II, Stage 1 study as a means of checking deeper groundwater quality.

The sampling and analysis plan (Table S-3) for the Robins AFB Phase II, Stage 1 study was based upon the suspected wastes reported for each zone (summarized in Table S-2). Implementation of the sampling and analysis plan involved installation of 25 new monitor wells. Pit casings were used to seal zones of contamination if wells penetrated an underlying confining bed. Sample collection (groundwater, surface water, leachate, sediment, and soil) followed the well installation phase of the work. Chemical analyses included pH, specific conductance, total organic halides (TOX), dissolved total organic carbon (DOC), purgeable organics, pesticides, polychlorinated biphenyls (PCB), total phenolics, cyanide, heavy metals, oil and grease, and organic priority pollutants according to the schedule shown in Table S-3. These analyses detected significant or potentially significant contamination in Zones 1 through 5 (Table S-4).

Zone 1

Analyses of samples from Zone 1 (Landfill No. 4 and the Sludge Lagoon) confirm contamination of groundwater, surface water, and sediment by organic solvents and cyanide. Nonspecific analyses for specific conductance, phenolics, DOC, and TOX support this conclusion. Groundwater contamination is highest in the vicinity of the Sludge Lagoon. Most

SUMMARY

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Consideration of the analytical results dictated recommendations (Table S-3) to better define both the extent of contamination and the chemical constituents contributing to contamination. Although recommendations for mitigative measures are beyond the scope of the Phase II, Stage 1 study, it was recommended that Zones 1 through 5 be evaluated in future studies which address the need for mitigation.

1.0 INTRODUCTION

1.0 INTRODUCTION

1.1 INSTALLATION RESTORATION PROGRAM BACKGROUND

The U.S. Air Force (USAF), due to its primary mission, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers of hazardous waste identify the locations and contents of disposal sites and take action to eliminate the hazards in an environmentally responsible manner. The primary federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of RCRA, federal agencies are directed to assist EPA, and under Section 3012 state agencies are required to inventory past disposal sites and make the information available to requesting agencies. To assure compliance with hazardous waste regulations, DOD developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by USAF message dated 21 January 1982. The IRP is the basis for response actions on USAF installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as clarified by Executive Order 12316.

The IRP is implemented in four phases. Phase I, Initial Assessment/Records Search, is designed to identify possible hazardous waste contaminated sites and potential problems that may result in contaminant migration from the installation. The Phase I report, completed for Robins AFB in April 1982 (Schroeder et al., 1982), reviews the history of base operations and waste disposal practices, the geological and hydrogeological conditions which may affect contaminant migration, and the ecological setting. All hazardous waste disposal sites identified in the Phase I report are ranked on the basis of a standard evaluation system [Hazardous Assessment Rating Methodology (HARM)], which is applied to all installation record searches (Table 1, Figure 1).

Table 1. Priority Ranking of Potential Contamination Sources at Robins AFB, Georgia as Given in the Phase I--Records Search

Rank*	Site Name	Date of Operation or Occurrence	Overall HARM Score
1†	Sludge Lagoon	1963-1978	77
2†	Landfill No. 4	1965-1978	73
3†	DDT Spill (1979)	1979	70
4†	Fire Protection Training Area No. 2	mid 1950s-mid 1960s	64
5†	Landfill No. 1	1943-1951	59
6†	Landfill No. 2	1951-1953	58
7†	JP-4 Spill (1965)	1965	57
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9†	Fire Protection Training Area No. 1	1943-mid 1950s	52
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11	Landfill No. 3	1964	47
12	Fire Protection Training Area No. 3	mid 1960s-1969	45
13	Low Level Radioactive Waste (Solid) Burial Site	1940s-1950s	31

*This ranking was performed according to the Hazardous Assessment Rating Methodology (HARM).

†Phase II, Stage 1 Study Sites.

Source: Schroeder et al., 1982.

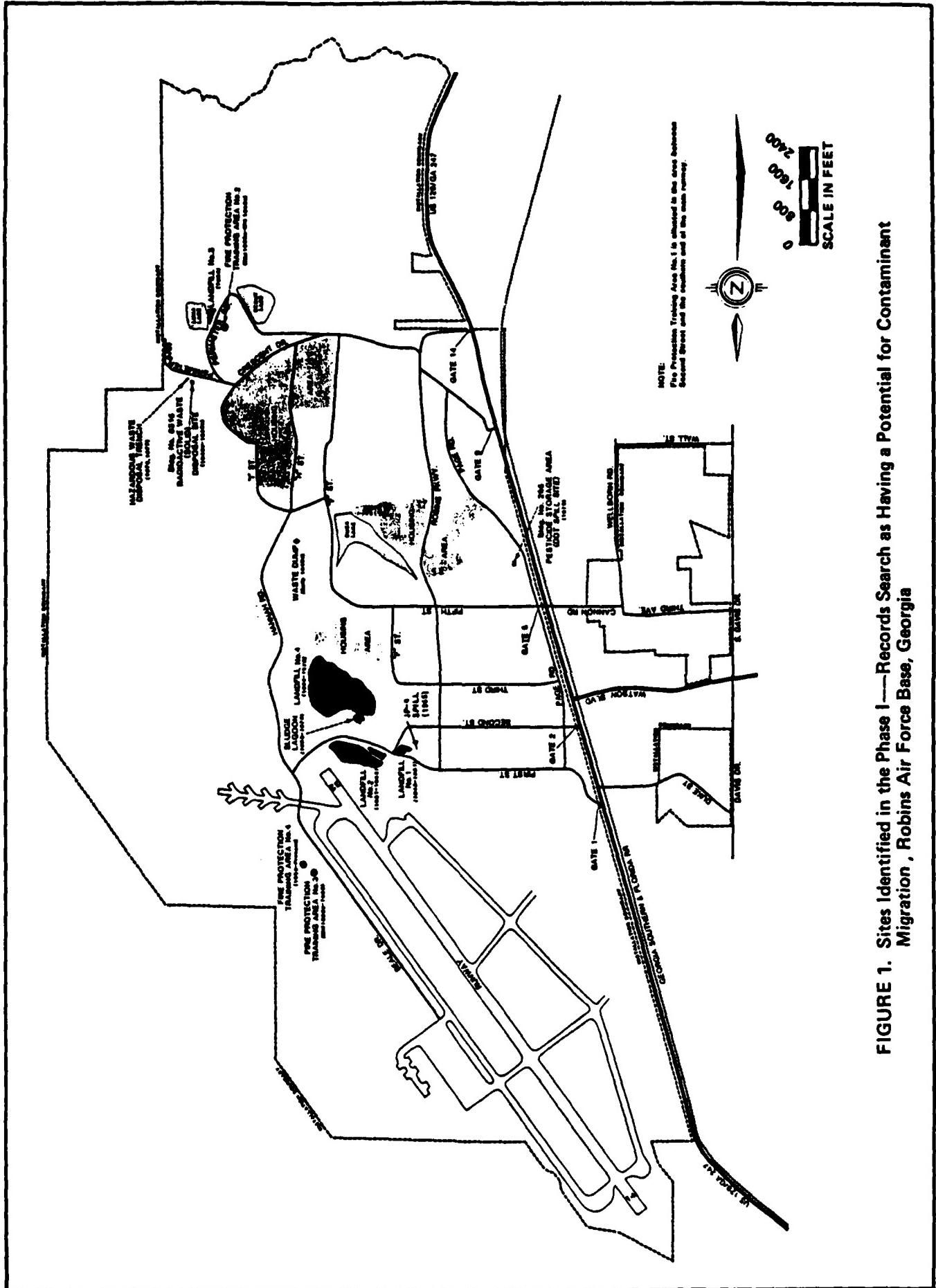


FIGURE 1. Sites Identified in the Phase I—Records Search as Having a Potential for Contamination
Migration, Robins Air Force Base, Georgia

Phase II, Confirmation and Quantification, is designed to confirm the presence and quantify the extent of contamination caused by migration of hazardous materials from present or abandoned waste disposal sites with HARM rankings indicative of significant environmental contamination.

Phase II IRP studies are implemented in stages. The Phase II presurvey was completed for Robins AFB in October 1982 (WAR, 1982) and consists of work plan development and costing of hydrogeological and chemical investigations. Phase II, Stage 1 described in this report, consists of field surveys, environmental sampling and analyses, data reduction and interpretation, and development of recommendations for additional monitoring and/or future evaluations to address mitigating measures. Phase II, Stage 2, if necessary, provides additional monitoring data upon which design of mitigative actions are based. In Phase III, Technology Base Development, appropriate technology is selected and the engineering design of corrective action options selected for implementation by the USAF is completed. Phase IV, Operations/Remedial Action, involves construction, operation, and maintenance of the corrective action option designed under Phase III.

WAR is currently under contract with the USAF to provide geotechnical, field sampling, analytical, and engineering expertise in the implementation of Phase II surveys at selected USAF facilities. WAR's contract, number F33615-81-D-4007, has been in effect since July 20, 1981. On September 29, 1982, Delivery Order 0005 was issued under WAR's contract to initiate the Phase II presurvey at Robins AFB. This action was based on results of the Robins AFB Phase I survey and HARM rankings of the sites investigated. Based on findings of the Phase I records search and Phase II presurvey, a scope of work was developed for the Robins AFB Phase II, Stage 1 survey. Delivery Order 0010 was issued to WAR on August 16, 1983 to initiate this work.

1.2 FACILITY HISTORY

Construction of Robins AFB began in 1941 on 3,000 acres donated by the City of Macon and Bibb County, Georgia. Subsequent land acquisitions

increased the size of the base to its present 8,855 acres (Figures 2 and 3).

During World War II, Robins AFB served as a training center and as a maintenance and repair depot. The USAF dropped training operations at Robins AFB after the war ended. Since that time, the base has been host organization for the Headquarters of the Fourteenth Air Force (1949 to 1960) and the Nineteenth Bombardment Wing (1958 to present).

1.3 STUDY AREA DESCRIPTIONS

Phase II, Stage 1 IRP study sites at Robins AFB included three landfills, two fire training areas, one industrial waste sludge lagoon, one DDT spill site, one hazardous waste burial site, and one JP-4 spill site. Since several of the sites were colocated, the IRP study sites were redefined as six zones (Table 2, Figure 4); four zones include pairs of sites. Water supply wells WS-3, WS-6, and WS-8 were included in the Phase II, Stage 1 study as a means of checking deeper groundwater quality.

1.3.1 Zone 1, Landfill No. 4 and Sludge Lagoon

Landfill No. 4 occupies an area of approximately 40 to 45 acres [Schroeder et al., 1982; Law Engineering Testing Company (LETCO), 1980] in the swamp south of Second Street and west of Hannah Road (Figure 4); the Sludge Lagoon is on the north side of Landfill No. 4 (Figure 5). Surface drainage for these sites is primarily to the east via a drainage ditch on the north side of the site. This ditch receives the discharge from the treatment plant, upstream of Landfill No. 4, and from other ditches which drain the runway area north of the site.

The Phase I report states that Landfill No. 4 and the Sludge Lagoon were in operation from 1965 to 1978 and from approximately 1962 to 1978, respectively; however, the landfill closure report (LETCO, 1980) indicates that these sites were in use until 1979. During this period, Landfill No. 4 received a variety of general refuse, garbage, and industrial

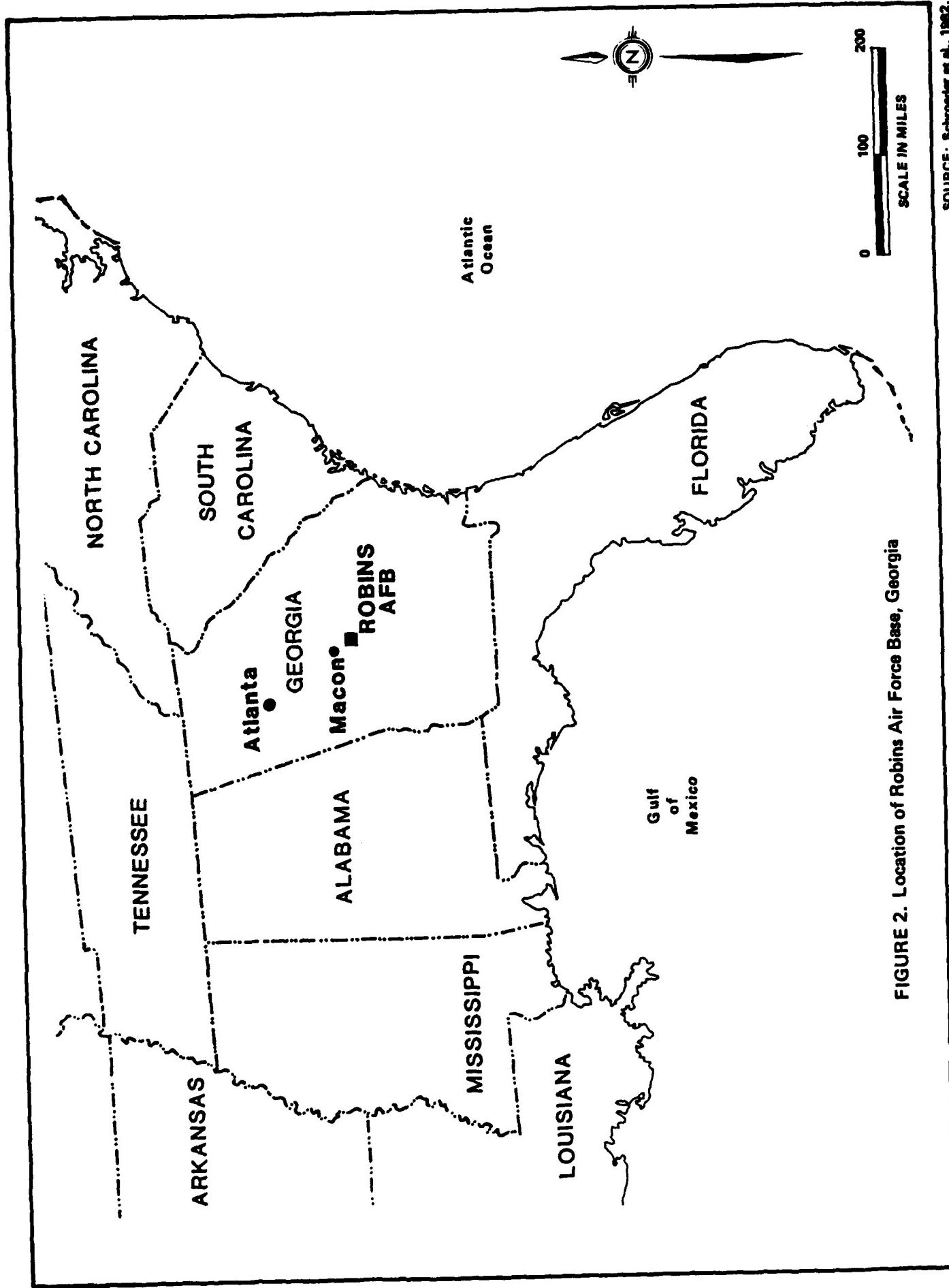


FIGURE 2. Location of Robins Air Force Base, Georgia

SOURCE: Schroeder et al., 1982.

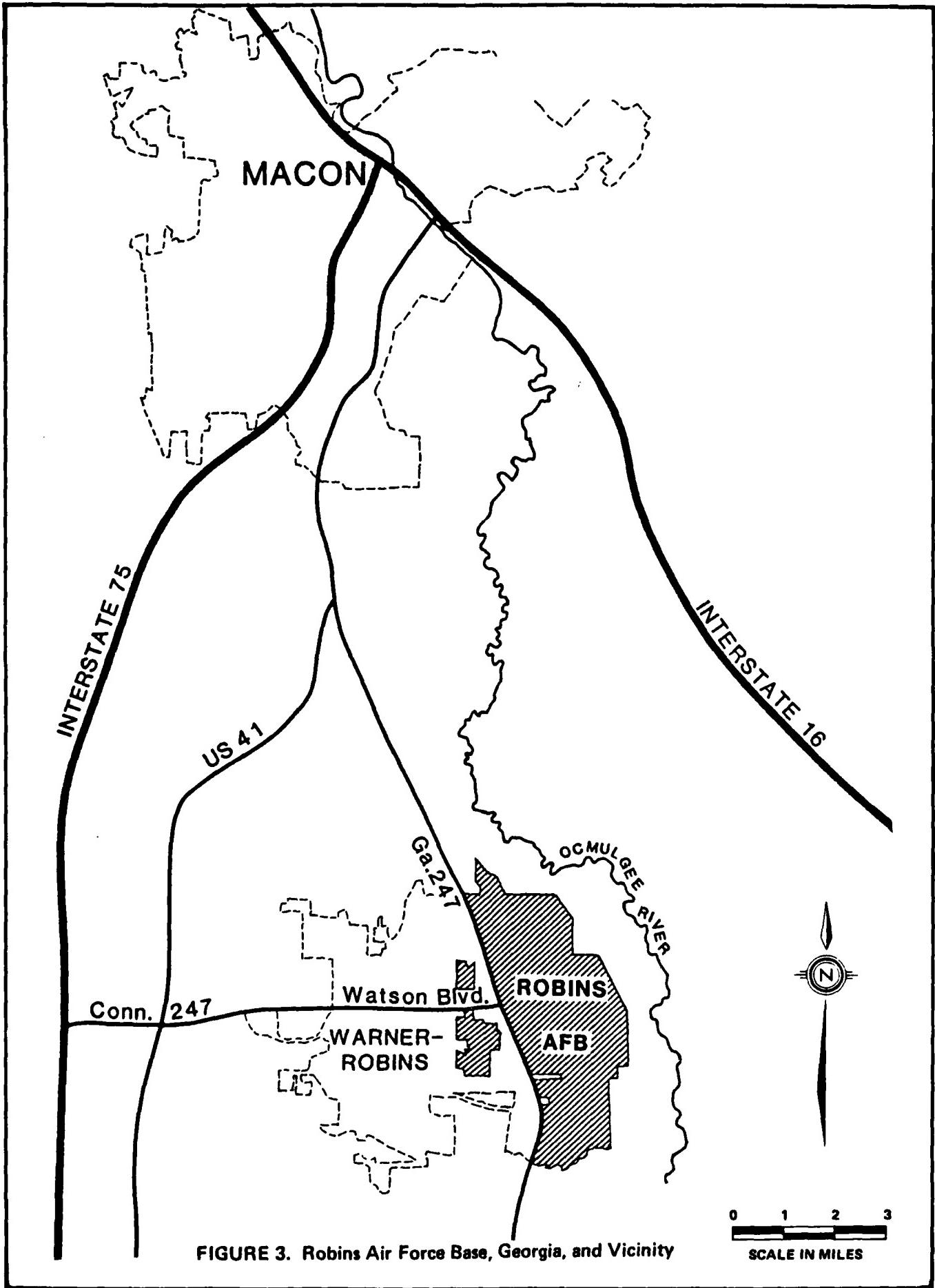


FIGURE 3. Robins Air Force Base, Georgia, and Vicinity

Table 2. Phase II, Stage 1 Field Evaluation Study Sites at Robins AFB, Georgia (Page 1 of 2)

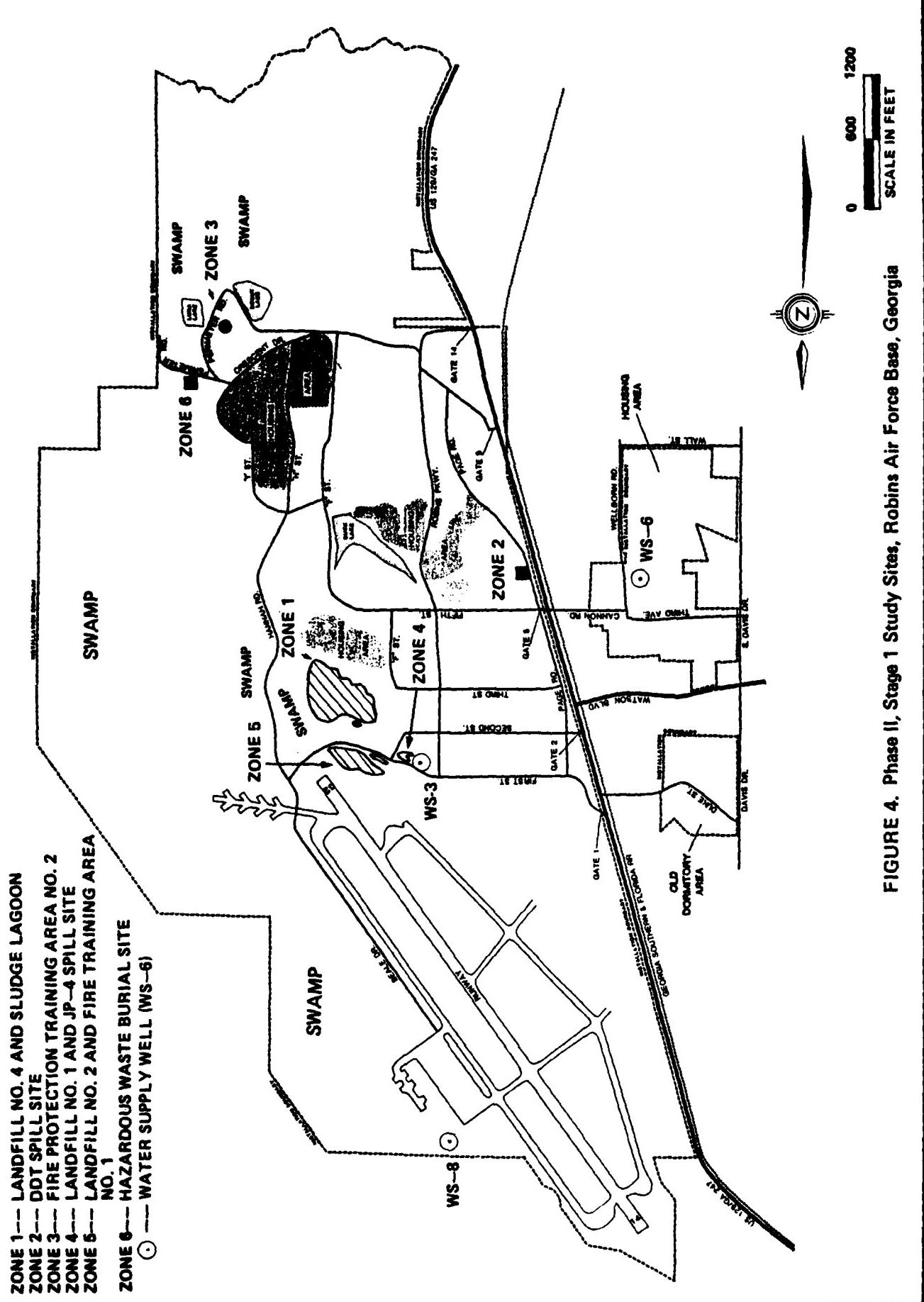
Site	Period of Operation	Approximate Size	Estimated Waste Volume	Suspected Types of Wastes
Zone 1 Landfill No. 4	1965 - 1978(79)	45 acres	484,000 YD ₃	General refuse, putrescible wastes, landfill, industrial wastes, approximately 200 55-gallon drums of industrial wastes stored at Landfill No. 4 in 1979.
Sludge Lagoon	1962 - 1978(79)	*	*	Sludge from industrial waste treatment plant No. 1 (phenols and oils). Sludge from industrial waste treatment plant No. 2 contained cyanide, chromiums, and other heavy metals. Paint removers, solvents, hydraulic fluids, and oils were also disposed of in the sludge lagoon.
Zone 2 DDT Spill Site	1979	*	55 GAL	DDT leaked from a drum in the pesticide storage area.
Zone 3 Fire Protection Training Area	1950s - 1960s No. 2	*	*	Contaminated fuel, oil, solvents, and ignitable chemicals.
Zone 4 Landfill No. 1 JP-4 Spill	(1943) 1946 - 1951 mid-1960s	2 acres	65,000 YD ₃ *	General refuse, industrial wastes, boiler ash, and incinerator ash. JP-4 seepage reported for several excavations in the vicinity of Landfill No. 1.

Table 2. Phase II, Stage 1 Field Evaluation Study Sites at Robins AFB, Georgia (Page 2 of 2)

Site	Period of Operation	Approximate Size	Estimated Waste Volume	Suspected Types of Wastes
Zone 5 Landfill No. 2	1951 - 1963	22 acres	580,000 YD ³	General refuse, industrial wastes, boiler ash, malathion (approximately 40 tons 1.5% aggregate).
Fire Training Area No. 1	1943 - 1950s	*	*	Contaminated fuel, oil, solvents, and ignitable chemicals.
Zone 6 Hazardous Waste Burial Site	1976 - 1977	200 ft. ²	>15 GAL	Approximately 240 aerosol cans of DDT with pyrethrin, mercury-contaminated wastes, and PCB-contaminated wastes. All encased in concrete and buried.

*Data not given in Phase I report.

Source: Schroeder et al., 1982.



SOURCE: Schroeder et al., 1982.

FIGURE 4. Phase II, Stage 1 Study Sites, Robins Air Force Base, Georgia

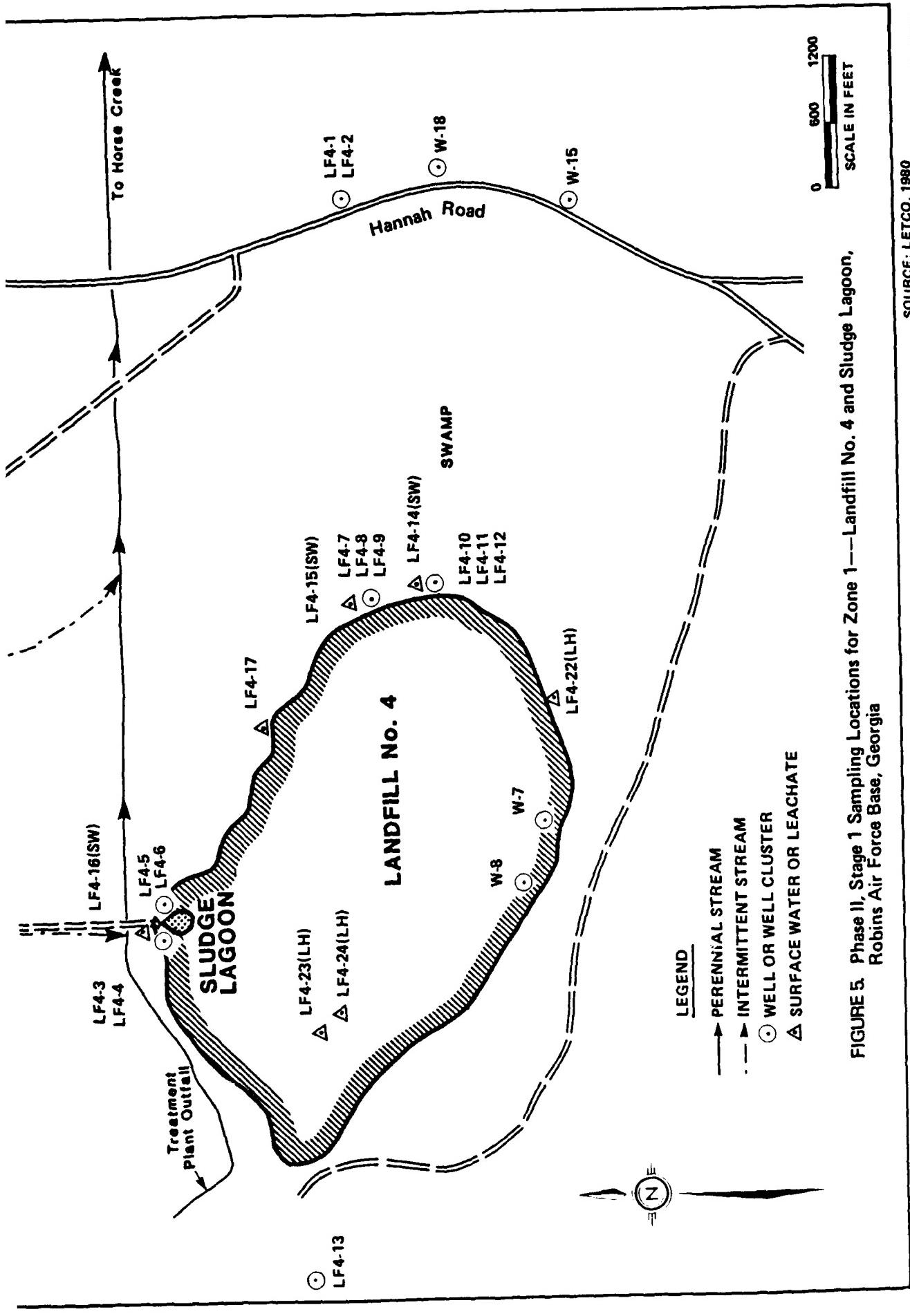


FIGURE 5. Phase II, Stage 1 Sampling Locations for Zone 1—Landfill No. 4 and Sludge Lagoon.
Robins Air Force Base, Georgia

SOURCE: LETCO, 1980
(as depicted in Schroeder et al., 1982.)

wastes, and the Sludge Lagoon received wastes from two industrial waste treatment plants plus other waste chemicals (Table 2). A landfill operation questionnaire included in the landfill closure report indicates that the approximate discharge to the Sludge Lagoon was 130,000 gallons per month of industrial liquid wastes and 104,000 gallons per month of grease and solvents.

Groundwater quality investigations coincident to closure of Landfill No. 4 (LETCO, 1980) revealed significant contamination of shallow groundwater downgradient of the landfill. Analyses conducted during that study detected high concentrations of phenolics (<2 to 1,900 ug/l), arsenic (<10 to 150 ug/l), chromium (<20 to 1,000 ug/l), lead (<20 to 240 ug/l), zinc (<40 to 89,000 ug/l), purgeable organics (>21,000 ug/l in one instance), and diethylphthalate. Appendix B contains the analytical results from the LETCO report. The presence of diethylphthalate may be related to high concentrations of solvents, since solvents could liberate plasticizers (phthalates) from the polyvinyl chloride (PVC) well casing and screens used in the monitor wells (EPA, 1977). In its report, LETCO noted an apparent degradation of monitor wells at the site.

LETCO (1980) concluded the following:

1. Landfill No. 4 is in a swamp with a high normal water level in an area subject to flooding.
2. A groundwater mound had developed at the landfill. LETCO stated that this was a common problem among landfills without sufficient cover to prevent infiltration.
3. Groundwater quality had deteriorated within Landfill No. 4, along its margins, and in three of the more distant wells. Water in the east-flowing drainage ditch north of Landfill No. 4 was also contaminated.
4. Although some pollutants (chloroform, methylene chloride, and toluene) were present in wells W-15 and W-18 (Figure 6), no clearly defined plume of contaminants was detected in the vicinity of the wells along Hannah Road. LETCO offered several

(Thomson et al., 1956). Robins AFB is located on a low alluvial terrace of the Ocmulgee River. The slope of the base, east of Highway 247, is towards the east with elevations of 300 feet mean sea level (msl) on the western edge of the site and 240 feet msl on the east along the Ocmulgee River. Much of the area bordering the base is low lying swamp land and parts of the base have been constructed over reclaimed swamp land.

2.2.2 Drainage

Robins AFB lies within the drainage basin of the Ocmulgee River, known as the Altamaha Basin (Figure 12). The installation is drained by several unnamed intermittent streams and by overland flow. Direction of surface flow is to the east, through the swamp (Figure 13).

A large portion of precipitation on the site may not become surface flow but rather infiltrates through the sandy soil. Based on the intensity of precipitation and on the amount of moisture in the soil, this water will probably recharge the shallow aquifer. Approximately 4.2 inches of total annual precipitation will become recharge to the shallow aquifer. Flooding is a problem on the eastern boundary of the base where the water table intersects the surface and results in swamp development. During flooding periods, Hannah Road becomes inundated, as do several other areas at the base including parts of some past waste disposal sites (Zones 1, 4, and 5).

2.2.3 Surface Soils

Surface soils of the Robins AFB area have been identified by the U.S. Department of Agriculture (USDA), Soil Conservation Service. Twenty soil types have been mapped within installation boundaries and are depicted in Figure 14. The individual soil types are discussed in Table 4. Base soils fall within two distinct groups: sandy upland soils and wet, organic lowland types. All the soil types present on the installation exhibit moderate to severe constraints on the development of waste disposal facilities, due either to permeability or flooding potential.

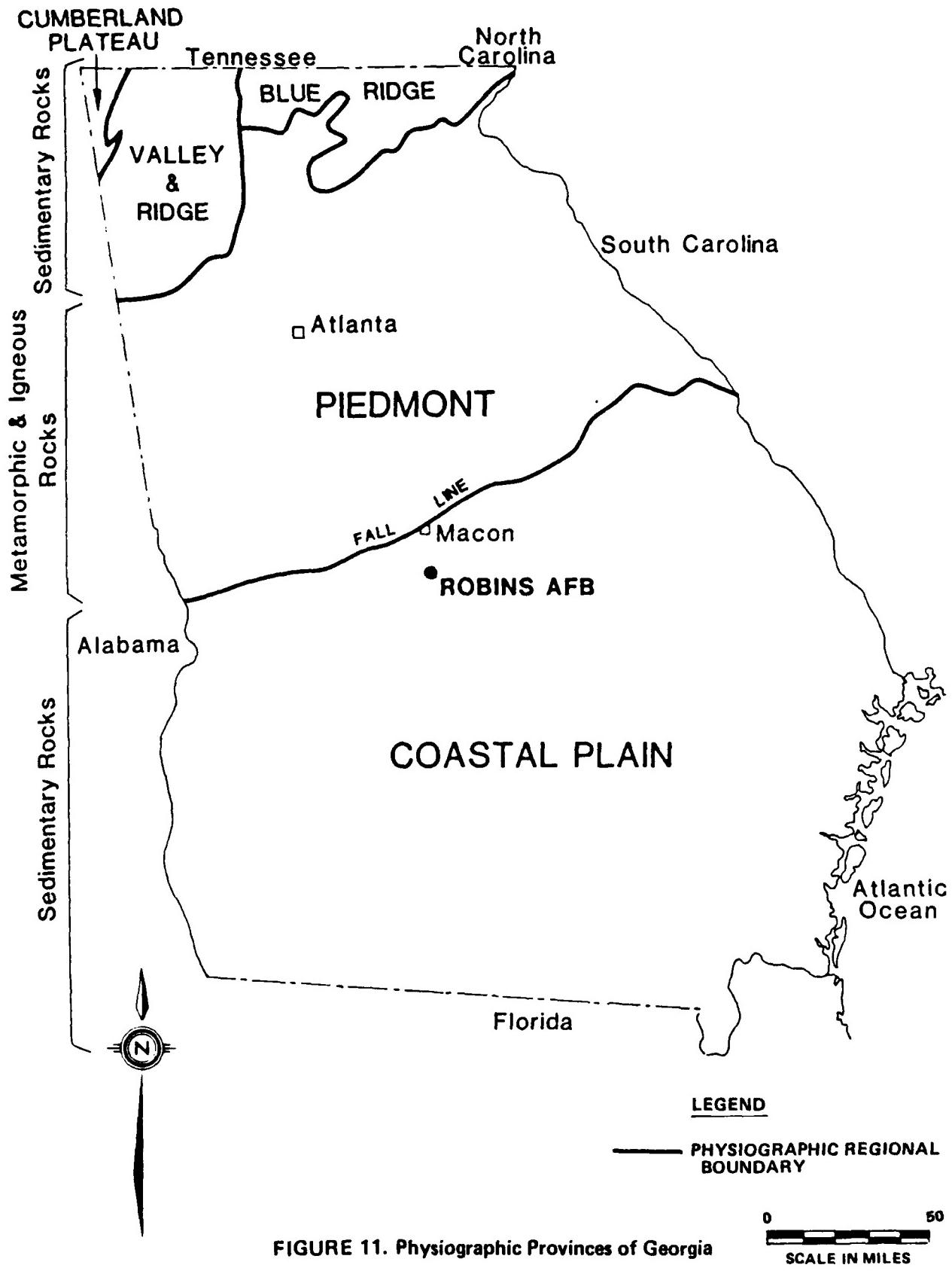


FIGURE 11. Physiographic Provinces of Georgia

Table 3. Robins AFB, Georgia Climatic Data

Month	Precipitation		Temperature		
	Mean (in.)	Max (min.)	Mean max (°F)	Mean (°F)	Mean min (°F)
January	4.0	8.4	57.5	47.5	37.2
February	4.5	9.0	60.7	50.2	39.2
March	4.8	10.6	67.7	56.9	45.7
April	3.2	8.4	76.9	65.4	53.6
May	3.5	7.2	84.0	73.1	61.7
June	3.7	7.0	88.9	78.9	68.5
July	5.1	9.3	90.3	81.1	71.6
August	3.8	6.7	90.2	80.7	70.9
September	2.9	7.9	85.3	75.8	65.9
October	2.2	7.4	77.1	65.8	54.0
November	2.2	5.4	67.3	55.6	43.5
December	4.4	11.5	59.5	49.2	38.5
Annual	44.3	--	75.5	65.0	54.2

Source: Global Climatology Branch, Robins AFB (as depicted in Schroeder et al., 1982).

2.0 ENVIRONMENTAL SETTING

The following discussion is reproduced from the Phase I report (Schroeder et al., 1982). It has been edited to ensure consistence of format with the present report.

The environmental setting of Robins AFB is described in this section with the primary emphasis directed toward identifying features which may affect the movement of hazardous waste contaminants. A summary of the environmental setting pertinent to this study is presented in Section 2.6.

2.1 METEOROLOGY

Temperature and precipitation data furnished by the Global Climatology Branch, Robins AFB, are presented in Table 3. The period of record is 33 years. The summarized data indicate that the mean annual precipitation is 44.1 inches. Using Thornthwaites Equation (Chow, 1964), potential evapotranspiration for the Warner Robins area is 42.0 inches.

2.2 GEOGRAPHY

Robins AFB lies along the upper margin of the Coastal Plain Province. The Coastal Plain is part of a large coastal province extending from Long Island, New York to the Mexican border (LeGrand, 1962). Just north of the study area lies the Piedmont Province (Figure 11). The line separating the more resistant crystalline rocks of the Piedmont Province from the less resistant deposits of the Coastal Plain Province is generally known as the Fall Line.

Locally, Robins AFB lies within the Coastal Plain Province and is situated on alluvial deposits along the Ocmulgee River. These deposits form a low terrace about 3 miles wide extending westward from the river to the City of Warner Robins.

2.2.1 Topography

The Coastal Plain is basically level with an eastward slope of approximately 2 to 3 feet per mile from the Fall Line to the Georgia coast

2.0 ENVIRONMENTAL SETTING

W.C. Zegel, Sc.D., P.E.--Project Director, Chemical Engineer
W.D. Adams, M.S.--Project Manager, Hydrogeologist
J.H. Sullivan, Ph.D., P.E.--Environmental Engineer
W.G. Thiess, M.S.--Environmental Engineer
C.R. Fellows, M.S.--Chemist
R.D. Baker, B.S.--Chemist

The following individuals provided important assistance to WAR during the field study at Robins AFB:

Col. B.T. Duffie	2853 CES/DE
Lt. Col. Harris	2853 CES/DEM
MSgt. J. Smith	2853 CES/DEMGE
Mr. C. Parkerson	2853 CES/DEMGE
Mr. D. Smith	2853 CES/DEMGE
Mr. P. Carswell	2853 CES/DEMGE
Mr. W. Kirkland	2853 CES/DEEXX
Mr. S. Politino	2853 CES/DEEXX
Mr. T.U. Milligan	2853 CES/DEMSW
Mr. H. Bryant	2853 CES/DEMSW

Their assistance included providing access to drilling sites, supplying additional information about the study sites, providing laboratory bench space during sampling, and providing access to production wells during sampling.

Lt. Col. A. Perry and Capt. S. Payne of Robins AFB BES took an active interest in all phases of the fieldwork and were most helpful in coordinating fieldwork with other activities on base. WAR is grateful to each of these people.

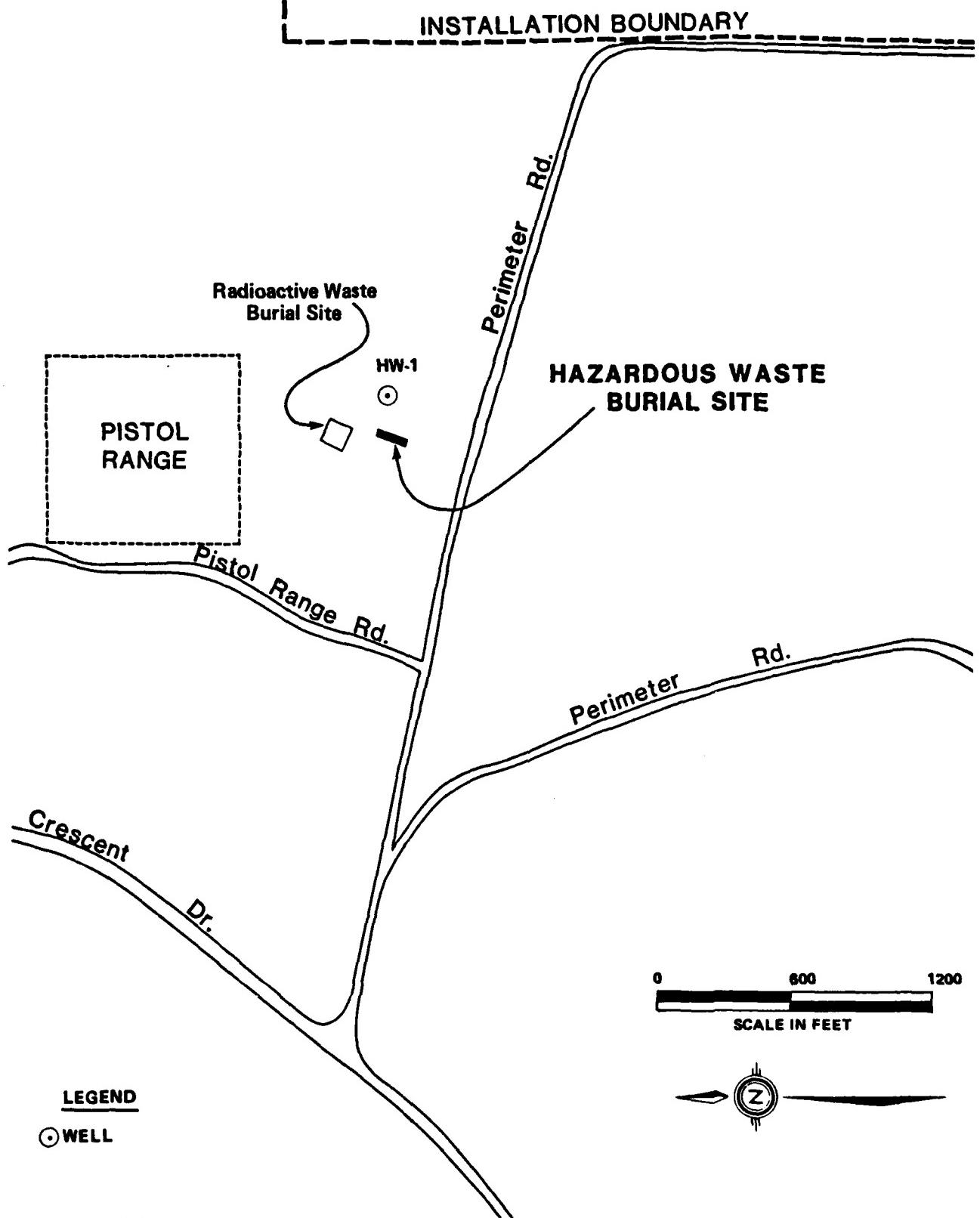


FIGURE 10. Monitor Well Location at Zone 6—Hazardous Waste Burial Site, Robins Air Force Base, Georgia

to those for Landfill No. 1 with the addition of 40 tons of off-specification pesticide [approximately 1.5 percent (1,200 pounds) granular malathion in clay or aggregate] at Landfill No. 2 (Schroeder et al., 1982). Schroeder et al. did not define the manner in which the pesticide was off-specification. Since 1963, Landfill No. 2 has been closed, covered with soil, and vegetated. Two drainage ditches adjacent to the site flow south, pass beneath Second Street, and empty into the east-flowing stream north of Landfill No. 4.

Fire Protection Training Area No. 1 (1943 to mid-1950s) consisted of an unlined pit rimmed with earthen dikes in the vicinity of Landfill Nos. 1 and 2. Schroeder et al. (1982) were unable to determine this site's precise location but concluded that it was in or by Landfill No. 2. Operations at Fire Protection Training Area No. 1 were similar to those described for Fire Protection Training Area No. 2 (Section 1.3.3).

1.3.6 Zone 6, Hazardous Waste Burial Site

In 1976 and 1977, small quantities of hazardous wastes were buried in a site that was approximately 10 feet by 20 feet (Figures 4 and 10). These wastes consisted of approximately 240 aerosol cans of DDT with pyrethrin, mercury-contaminated materials, and PCB-contaminated material. Each batch of hazardous wastes was buried after being encapsulated in concrete (Schroeder et al., 1982).

1.3.7 Water Supply Wells 3, 6, and 8

These wells were included in the Phase II, Stage 1 study for a general check of raw water quality. Water supply well 3 is the only well of these three near any of the Phase II, Stage 1 study sites; it is approximately 800 feet upgradient of Zone 4 [Landfill No. 1 and JP-4 Spill Site (Figure 4)].

1.4 PROJECT STAFF

WAR's project staff consists of the following people whose resumes are included in Appendix C:

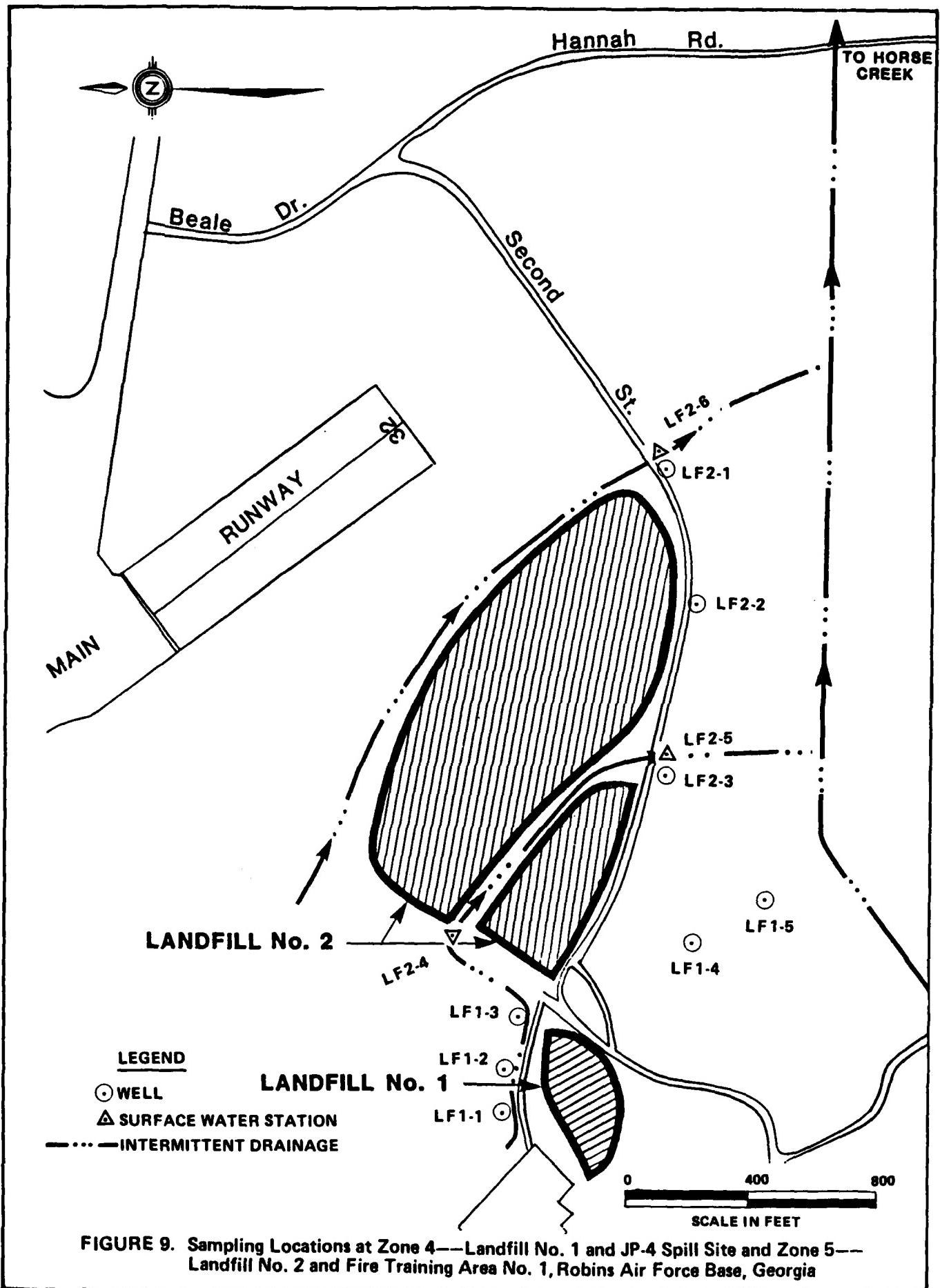


FIGURE 9. Sampling Locations at Zone 4—Landfill No. 1 and JP-4 Spill Site and Zone 5—Landfill No. 2 and Fire Training Area No. 1, Robins Air Force Base, Georgia

contaminated fuel, oil, solvents, and ignitable chemicals on ground which had been soaked with water. The fire department would then repeatedly ignite the combustible mixture and extinguish the ensuing fire until the area would no longer burn. While Fire Protection Area No. 2 was in use, protein foam was the principal fire fighting agent used at Robins AFB (Schroeder et al., 1982).

1.3.4 Zone 4, Landfill No. 1 and JP-4 Spill Site

Landfill No. 1 was in operation from 1943 (1946?) until 1951 and consisted of approximately 2 acres near the fuel farm (Figures 4 and 9). The landfill was a trench and fill operation with a daily cover of boiler ash; trench depths were 20 feet and sometimes extended below the water table. Suspected wastes include general refuse, industrial wastes, boiler ash, and incinerator ash (Schroeder et al., 1982).

An undetermined amount of JP-4 leaked from a 4-inch diameter, underground fuel supply line during the mid-1960s and seeped into the ground near Landfill No. 1. The leak was discovered in 1965 during construction of an impact test facility at Landfill No. 1 when JP-4 seeped into an excavation at the construction site. The leak was repaired; however, subsequent excavations in the area have encountered fuel.

Robins AFB began construction of new fuel storage tanks on the site of Landfill No. 1 during 1983, before the start of the Phase II, Stage 1 fieldwork. Prior to the start of construction, most of the contents of Landfill No. 1 were excavated and transported off-base for redisposal. Construction workers at the site reported that they encountered fuel in the excavations; they also stated that they believed the landfill extends south under Second Street and under Building 352.

1.3.5 Zone 5, Landfill No. 2 and Fire Training Area No. 1

Landfill No. 2 is east of Landfill No. 1 (Figures 4 and 9). It consists of approximately 22 acres and was operated from 1951 to 1963 in the same manner as Landfill No. 1. Suspected wastes at Landfill No. 2 are similar

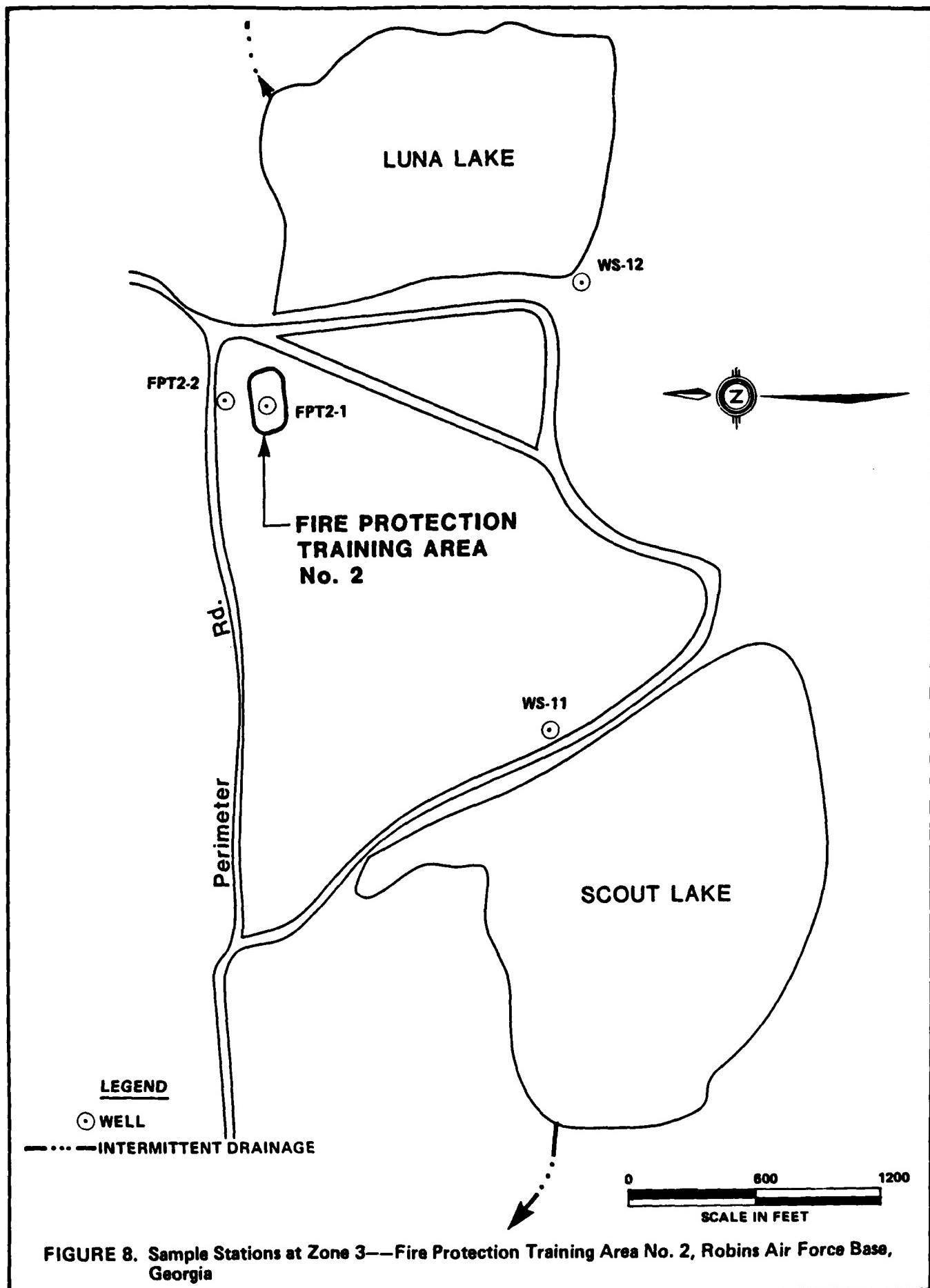


FIGURE 8. Sample Stations at Zone 3—Fire Protection Training Area No. 2, Robins Air Force Base, Georgia

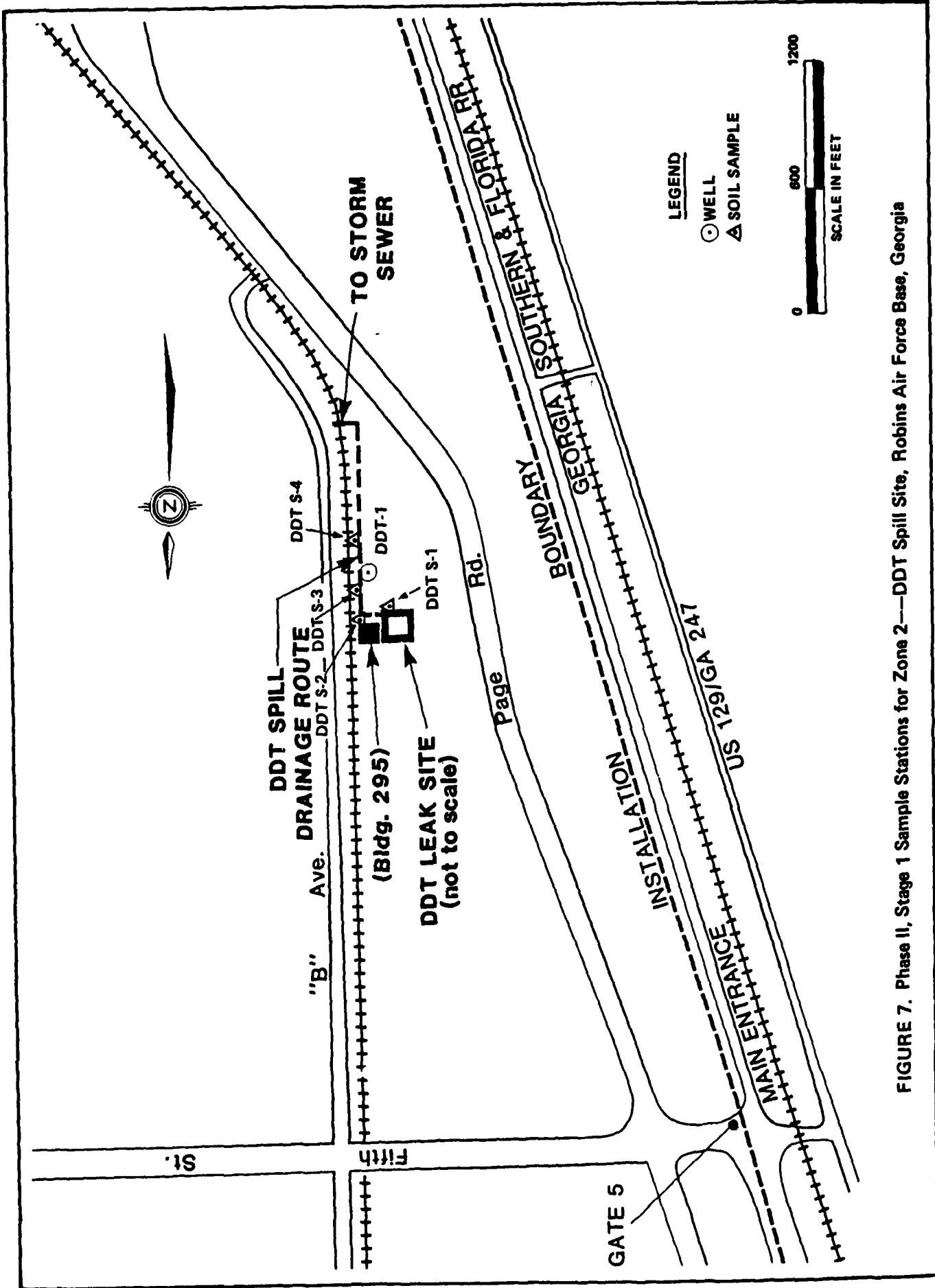


FIGURE 7. Phase II, Stage 1 Sample Stations for Zone 2—DDT Spill Site, Robins Air Force Base, Georgia

BASE MAP: Robins AFB Installation Documents
(as depicted in Schroeder et al., 1982).

hypotheses to account for the lack of a well-defined plume. These included differential mobility of contaminants, attenuation of contaminants by organic soils, exclusion of contaminants from the underlying sands by artesian conditions, age of the landfill, and seasonal variations of leachate production.

1.3.2 Zone 2, DDT Spill Site

This site is near the western boundary of Robins AFB (Figure 4) and is adjacent to the Entomology Shop in Building 295 (Figure 7). The spill occurred in October 1979 when 55 gallons of DDT solution leaked from a drum in a gravel-covered section of the chemical storage area. Personnel from the Bioenvironmental Engineering Services (BES) sampled soil from the site and from the drainage path leading from the site. DDT concentrations in these soil samples varied from 7,600 parts per million (ppm) for soil taken 6 to 10 inches beneath the surface of the spill site down to 3 ppm at the entrance to the storm sewer leading to Duck Lake (Schroeder et al., 1982). Since the leak was discovered, an asphalt pad with a 4-inch high perimeter curb has been installed at the chemical storage area adjacent to Building 295.

BES personnel collected samples of catfish from Duck Lake for DDT analysis in 1982 and 1983 (Payne, 1984). From each collection, two groups of fillets from five fish were composited and analyzed for total DDT content. Results of the analyses in 1982 were 2.60 and 4.10 micrograms per gram (ug/g) for the two composite samples. In 1983, total DDT was 3.20 and 4.00 ug/g. None of these results exceeded the Food and Drug Administration (FDA) action level for DDT in fish of 5 ug/g (FDA, 1981).

1.3.3 Zone 3, Fire Protection Training Area No. 2

This site is west of Luna Lake (Figures 4 and 8) and was in use from the mid-1950s until the early to mid-1960s (Schroeder et al., 1982). According to the Phase I report, Fire Protection Training Area No. 2 consisted of several sites in the general area shown in Figure 8. The usual practice at fire training areas until the mid-1960s was to dump drums of

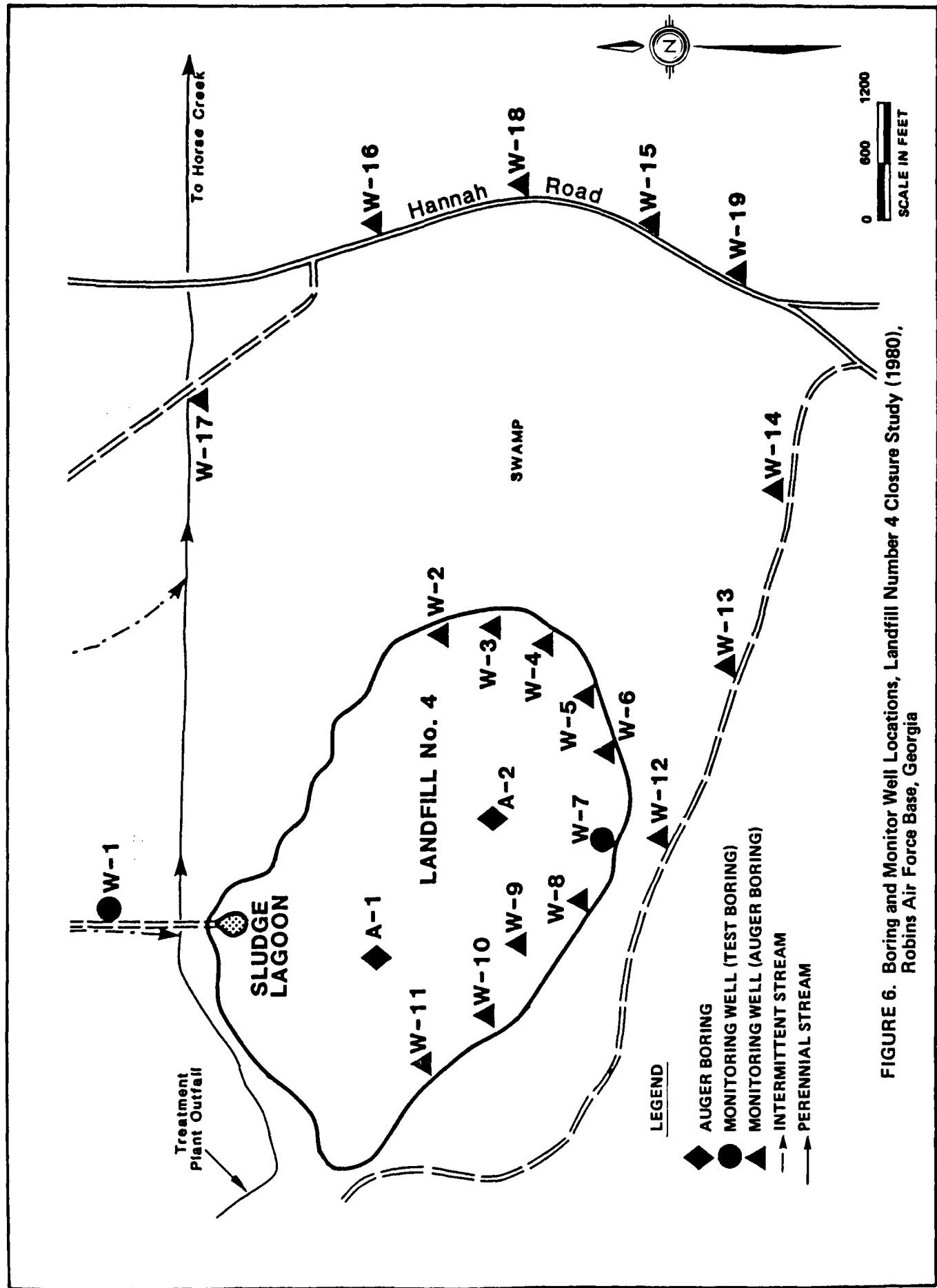


FIGURE 6. Boring and Monitor Well Locations, Landfill Number 4 Closure Study (1980),
Robins Air Force Base, Georgia

SOURCE: LETCO, 1980
(as depicted in Schroeder et al., 1982).

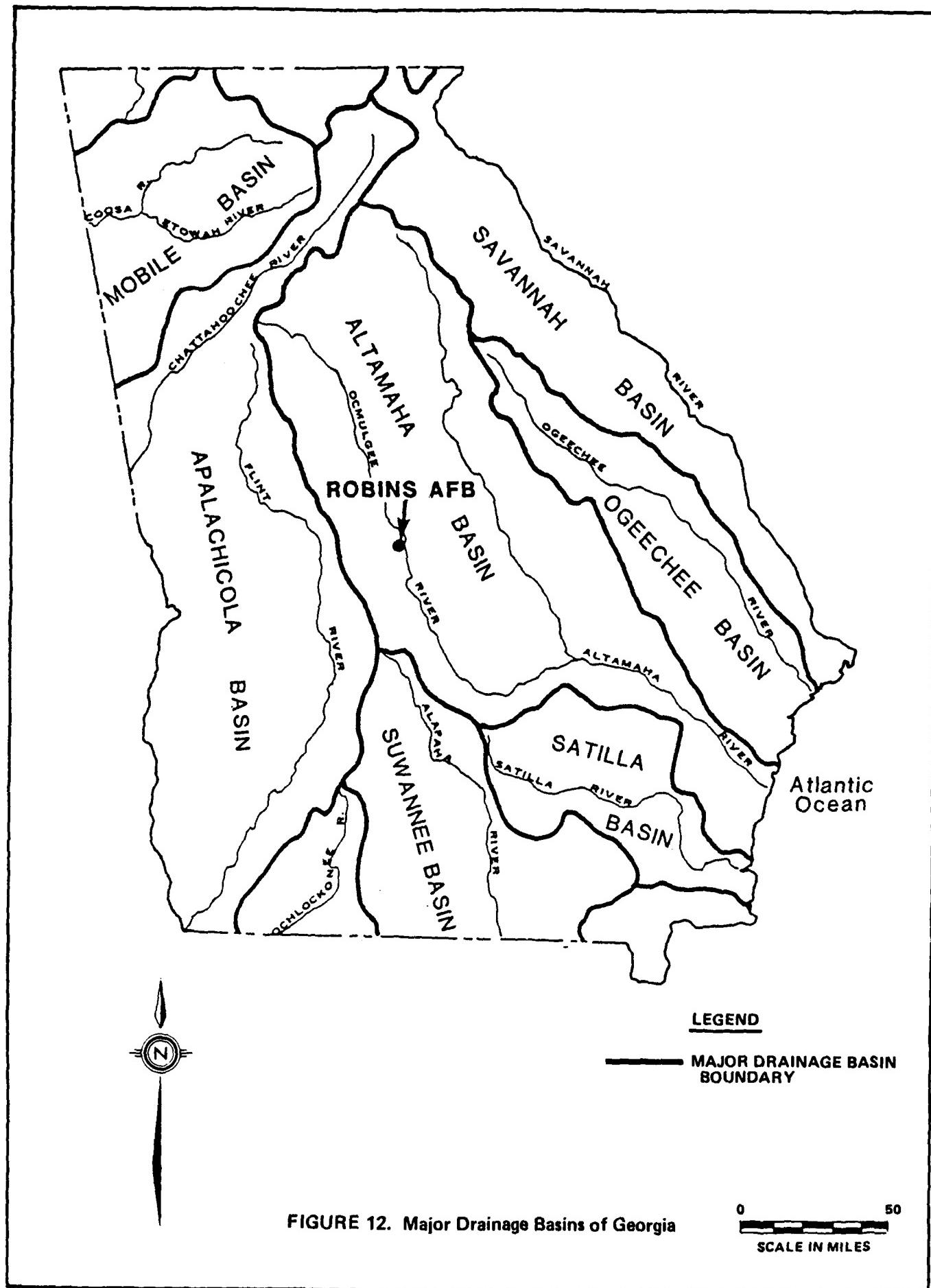


FIGURE 12. Major Drainage Basins of Georgia

SOURCE: Thomson et al., 1956
(as depicted in Schroeder et al., 1982).

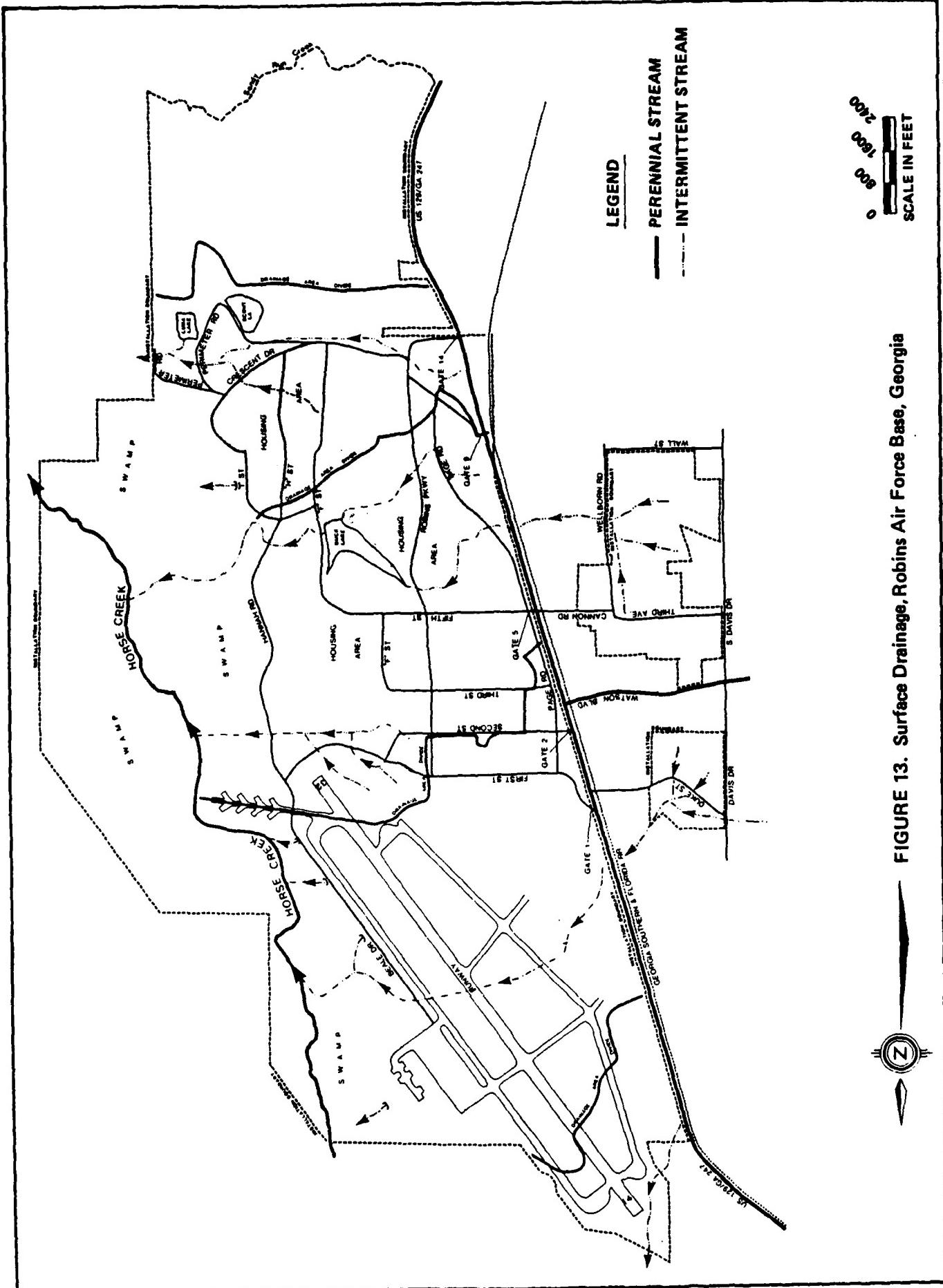


FIGURE 13. Surface Drainage, Robins Air Force Base, Georgia

SOURCE: Robins AFB Installation Documents
(as depicted in Schroeder et al., 1992).

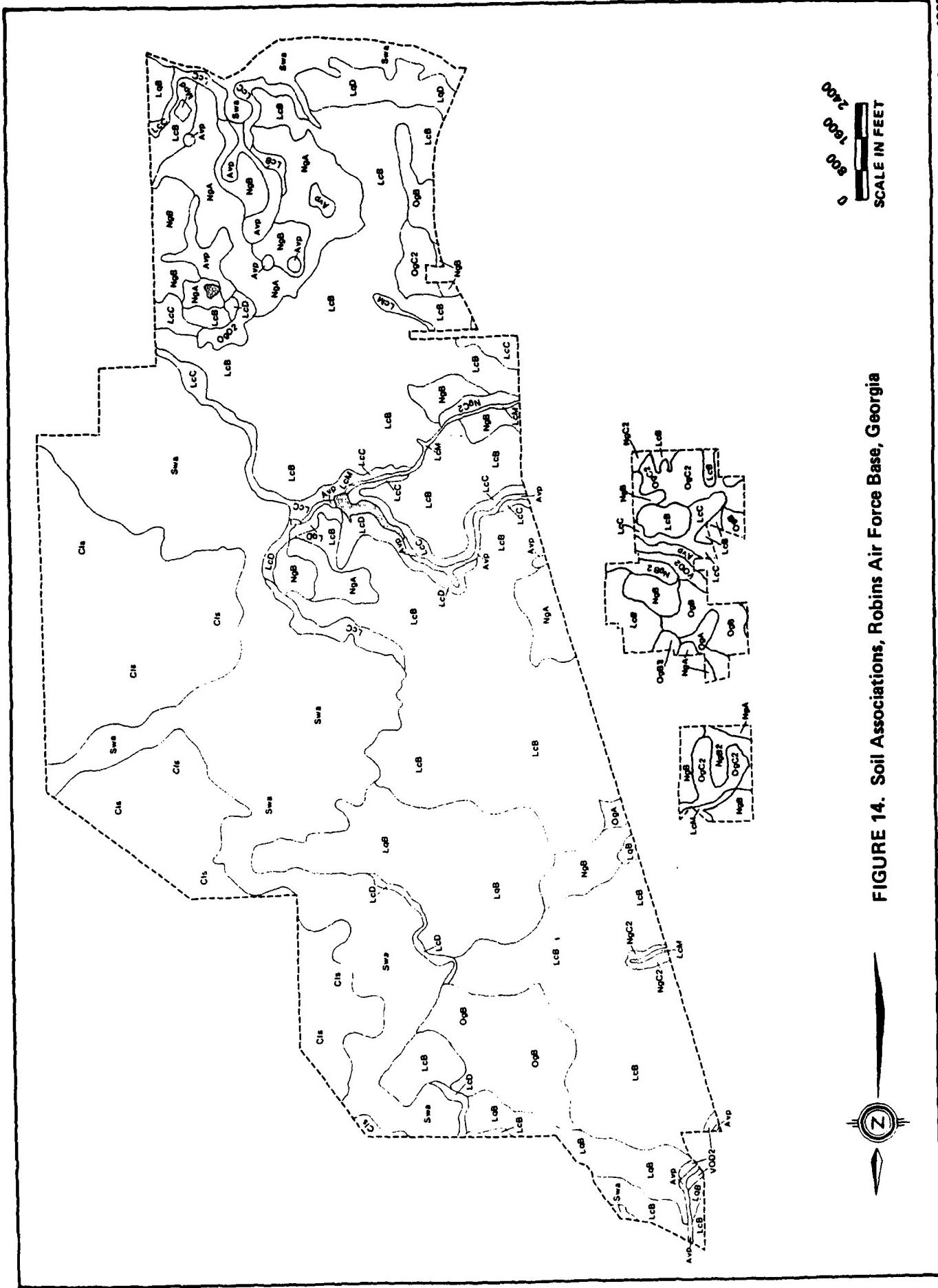


FIGURE 14. Soil Associations, Robins Air Force Base, Georgia

SOURCE: USDA—Soil Conservation Survey, 1987
(as depicted in Schroeder et al., 1982).

Table 4. Robins AFB, Georgia Soils

Symbol	Description	USDA Texture	Thickness (in.)	Unified Classification	Permeability (in/hr)	RWD Facility Use Constraints
AvP	Aluvial land, wet, 0-2% slopes	Organic clay loam, clay	36+	SC, CL, CH, OH	Not estimated	Severe-floods
Cls	Chastain leaf soils, 0-2% slopes	Silt loam, silty clay loam, silty clay, clay	50	ML, CL	<0.2 - 0.63	Severe-floods
LcB	Lucy sand, 0-5% slopes	Sand, loamy sand, sandy	60	SP, SM, SC, CL	0.63 - >6.3	Severe-high permeability
LcC	Lucy sand, 5-8% slopes	Sand, loamy sand, sandy	60	SP, SM, SC, CL	0.63 - >6.3	Severe-high permeability
LcD	Lucy sand, 8-12% slopes	Sand, loamy sand, sandy	60	SP, SM, SC, CL	0.63 - >6.3	Severe-high permeability
LcM	Local alluvial land, 0-2% slopes	This unit is highly variable.	24-36	Properties not estimated	Severe-floods	
LqB	Lakeland fine sand, 0-5% slopes	Fine sand, sand	60	SP, SM	>6.3	Severe-high permeability
LqD	Lakeland fine sand, 5-12% slopes	Fine sand, sand	60	SP, SM	>6.3	Severe-high permeability
NgA	Norfolk loamy fine sand, 0-2% slopes	Loamy fine sand, sandy clay loam	58	SM, SC, CL	0.63 - >6.3	Moderate permeability
NgB	Norfolk loamy fine sand, 2-5% slopes	Loamy fine sand, sandy clay loam	58	SM, SC, CL	0.63 - >6.3	Moderate permeability
NgB2	Norfolk loamy fine sand, 2-5% slopes, eroded	Loamy fine sand, sandy clay loam	58	SM, SC, CL	0.63 - >6.3	Moderate permeability
NgC2	Norfolk loamy fine sand, 5-8% slopes, eroded	Loamy fine sand, sandy clay loam	58	SM, SC, CL	0.63 - >6.3	Moderate permeability
OgA	Orangeburg loamy fine sand, 0-2% slopes	Loamy fine sand, sandy clay loam	64	SM, SC	0.63 - >6.3	Moderate permeability
OgB	Orangeburg loamy fine sand, 2-5% slopes	Loamy fine sand, sandy clay loam	64	SM, SC	0.63 - >6.3	Moderate permeability
OgB2	Orangeburg loamy fine sand, 2-5% slopes, eroded	Loamy fine sand, sandy clay loam	64	SM, SC	0.63 - >6.3	Moderate permeability
OgC2	Orangeburg loamy fine sand, 5-8% slopes, eroded	Loamy fine sand, sandy clay loam	64	SM, SC	0.63 - >6.3	Moderate permeability
OgD2	Orangeburg loamy fine sand, 8-12% slopes, eroded	Loamy fine sand, sandy clay loam	64	SM, SC	0.63 - >6.3	Moderate permeability
RhA	Red Bay fine sandy loam, 0-2% slopes	Fine sandy loam, sandy clay loam	70	SM, SC, CL	0.63 - >6.3	Moderate permeability
Swa	Swamp	Perennial wetland		Properties not estimated	Severe-floods	
WOD2	Vaucluse-Hoffman complex, 8-12% slopes, eroded	Loamy sand, sandy clay loam	60	SM, SC, CL	0.63 - >6.3	Moderate permeability

Source: SCS, 1967 (as depicted in Schroeder et al., 1982).

2.3 GEOLOGY

The geology of the Robins AFB vicinity has been reported by LeGrand (1962); Herrick (1961, 1965); Thomson et al. (1956); Herrick and Vorhis (1963); Sonderegger (1978); Pollard and Vorhis (1980); and Mitchell (1979) among others. A brief review of their work has been summarized in support of this investigation.

2.3.1 Stratigraphy

Stratigraphy of the area was studied in order to understand the occurrence and movement of groundwater beneath the site. Geologic units ranging in age from Cretaceous to Quaternary have been described in the Warner Robins area and are presented in Table 5. The lithologies of these units are typically unconsolidated material. Older Cretaceous units are encountered at depths of approximately 1,700 feet. Crystalline basement rocks are typically encountered at depths greater than 1,750 feet below ground surface (LeGrand, 1962).

Regionally, the site is located within the upper Coastal Plain Province, but locally, lies on an alluvial terrace of the Ocmulgee River. Sections of the base constructed in swamps have been built up over fill material and do not represent original stratigraphic sequences. The uppermost native unit consists of alluvial deposits of two types depending upon exact location on the base (refer to geologic map and legend, Figure 15). In the lowland or swampy areas typical of the eastern portion of the base, as well as beneath many of the artificially filled areas, a 5- to 15-foot-thick layer of peat and fine silts are encountered, generally underlain by a thin (3 to 5 feet) layer of clay. In upland areas typical of the western half of the base, however, fine alluvial sands and silts are present at the surface and grade into sands and fine gravels with increasing depth. A clay layer is not known to exist below these deposits. These sand and fine gravel alluvial deposits also underlie the organic deposits in the lowlands. These are recent deposits and may be 20 to 25 feet thick.

Table 5. Geologic Formations in Robins AFB, Georgia Area

System	Series	Formation	Thickness (feet)
Quaternary	Pliocene to Recent	Peat, organic silty clays deposited in Ocmulgee River generally over alluvium.	5-20
		Silts, sands, and gravels deposited along major stream borders and in interstream areas.	
Tertiary	NONE PRESENT UNDERLYING ROBINS AFB		
Cretaceous	Upper	Providence Sand: Tuscaloosa Formation:	Light colored sand interbedded with lenticular layers of clay. Light colored sand interbedded with several lenticular layers of clay.
			60-120 500-600

Source: LeGrand, 1962 (as depicted in Schroeder et al., 1982).

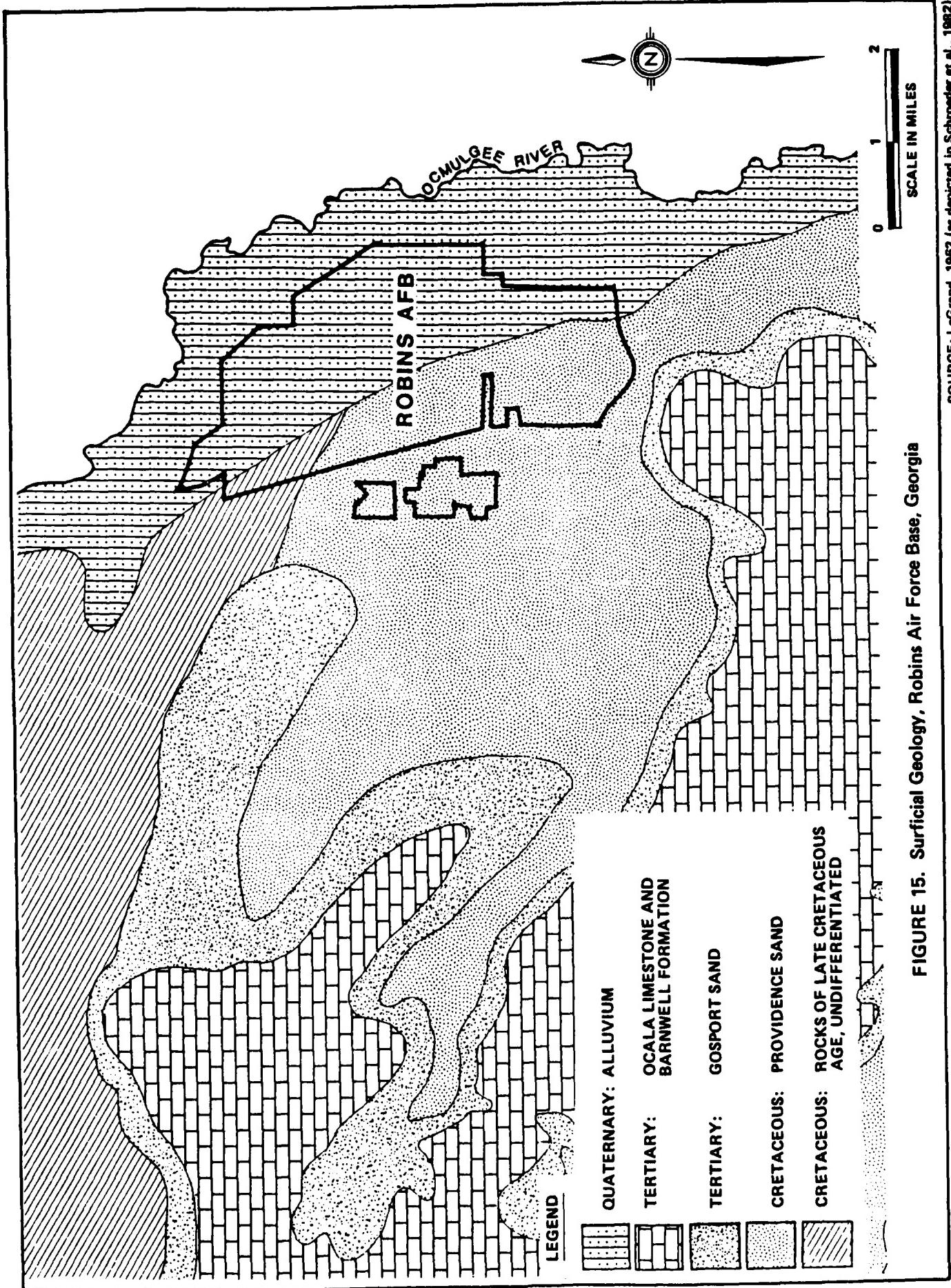


FIGURE 15. Surficial Geology, Robins Air Force Base, Georgia

SOURCE: LeGrand, 1962 (as depicted in Schroeder et al., 1982).

Directly below the surficial alluvial deposits are the most significant geologic units, comprised primarily of several hundred feet of permeable sands. The uppermost major unit is the Providence Sand. It is the youngest and uppermost Cretaceous formation in Georgia. It consists of light colored sands, interbedded with numerous layers of clay. Thickness of the Providence Sand ranges from 60 to 120 feet and is approximately 60 feet at Robins AFB (LeGrand, 1962).

Immediately underlying the Providence Sand is the Tuscaloosa Formation. Although it does not crop out at the base, it is the oldest outcropping formation of Georgia's Coastal Plain (LeGrand, 1962). Lithologically, the Tuscaloosa Formation is almost identifical to the Providence Sand. It also consists of a light-colored sand with numerous lenticular masses of clay interbedded throughout the formation. These clay beds are generally lenses which cannot be traced far. Thickness of this formation ranges from 500 to 600 feet. A generalized geologic section depicting the relationships of major geologic units is presented in Figure 16. The Tuscaloosa Formation is a superb aquifer capable of producing tremendous quantities of excellent quality water. Both Robins AFB and the City of Warner Robins use this formation as a source of their water supplies.

Immediately below the Tuscaloosa Formation are crystalline rocks of Paleozoic, or possibly older, Age. No records were found of wells reaching bedrock; therefore, the exact depth to these units is uncertain. Due to the depth and nature of these formations, they would not be a significant source of water in this area.

The areal distribution of geologic units significant to this study is mapped on Figure 15, which is modified from the work published by LeGrand (1962). Most of the site is immediately underlain by alluvial deposits of the Ocmulgee River. The depth to consolidated deposits is not confirmed, but is presumed to be at least 1,700 feet below the surface, based upon regional geologic data. The western (upland) part of

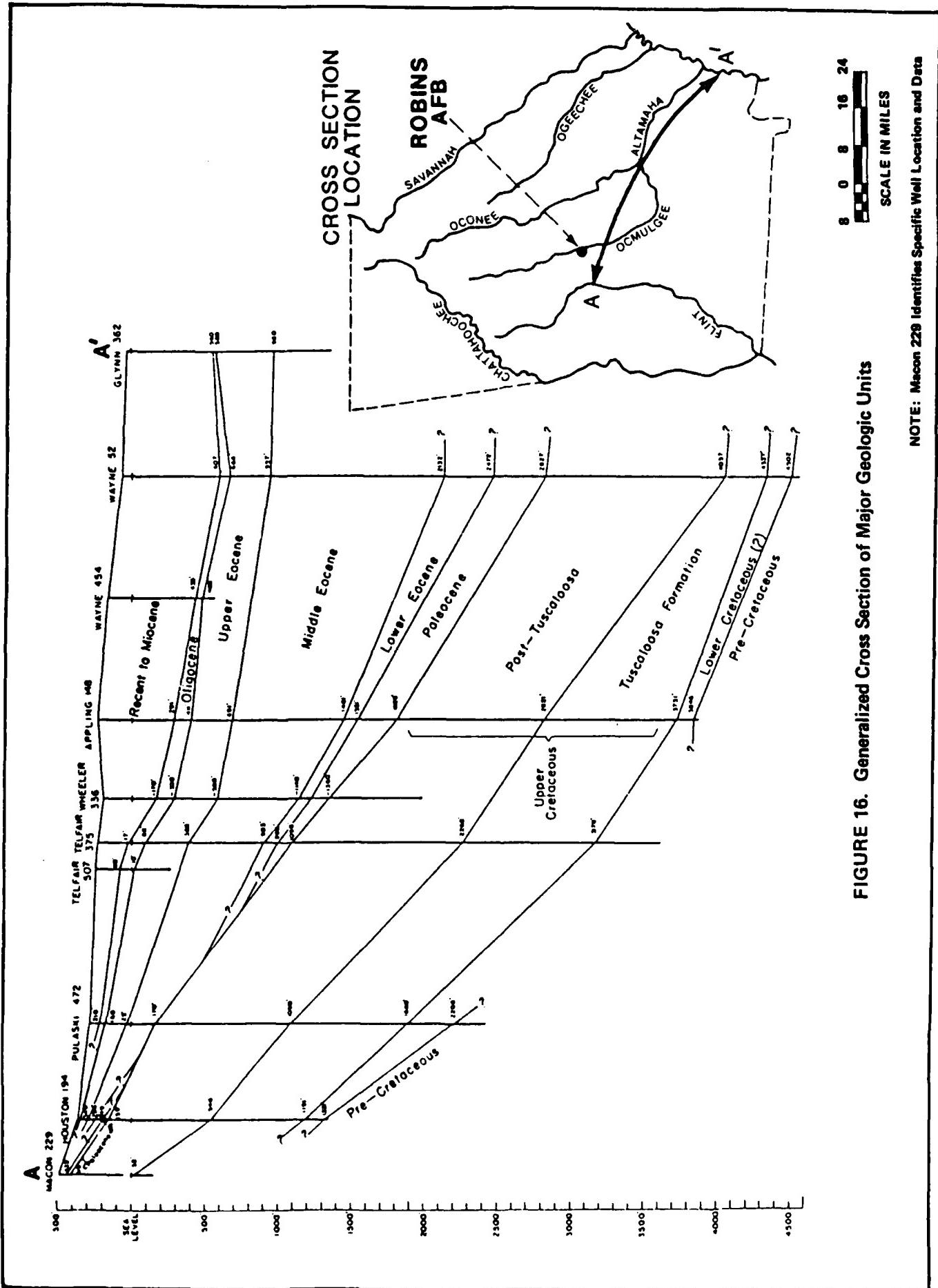


FIGURE 16. Generalized Cross Section of Major Geologic Units

SCALE IN MILES

NOTE: Macon 229 Identifies Specific Well Location and Data

SOURCE: Herrick and Vorhis, 1963 (as depicted in Schroeder et al., 1982).

the base is dominated by sandy alluvial deposits, but the eastern (swamp) part of the base is underlain by peat and fine-grained organic silt deposits.

2.4 HYDROGEOLOGY

Groundwater hydrology of the Warner Robins area has been reported by LeGrand (1962), Mitchell (1979), Pollard and Vorhis (1980), Thomson et al. (1956), Herrick (1961), and Sonderegger (1978). Supporting information has been obtained from Robins AFB water department files and files from the City of Warner Robins water plant. Additional information on permeabilities and shallow groundwater quality were obtained from a report by LETCO (1980).

The Coastal Plain Province in Georgia extends from the Fall Line on the north to Florida on the south and from the Savannah River and the Atlantic Ocean on the east to the Chattahoochee River on the west. The Coastal Plain may be divided into three areas (Figure 17) according to aquifer availability and utilization (Thomson et al., 1956). Along the Fall Line, and for a distance of 30 to 60 miles south of it, sand and gravel of Cretaceous Age constitute the principle aquifer. Sands and gravels of both the Providence Sand and Tuscaloosa Formation comprise the Cretaceous Sand Aquifer which extends from land surface to a depth of 600 to 700 feet below the surface at Robins AFB. These sands and gravels may be divided into localized aquifer zones by confining beds of limited extent.

An important consideration in assessing groundwater contamination is the water present in the upper alluvial deposits. These deposits are not used locally as a source of water supply, although some degree of interconnection may occur between these deposits and the underlying formations.

Groundwater exists beneath Robins AFB under both water table and artesian conditions. The water table is present throughout the western part of the base in the upper sandy alluvial deposits. The water table discharges to the east and contributes to the development of a swampy area

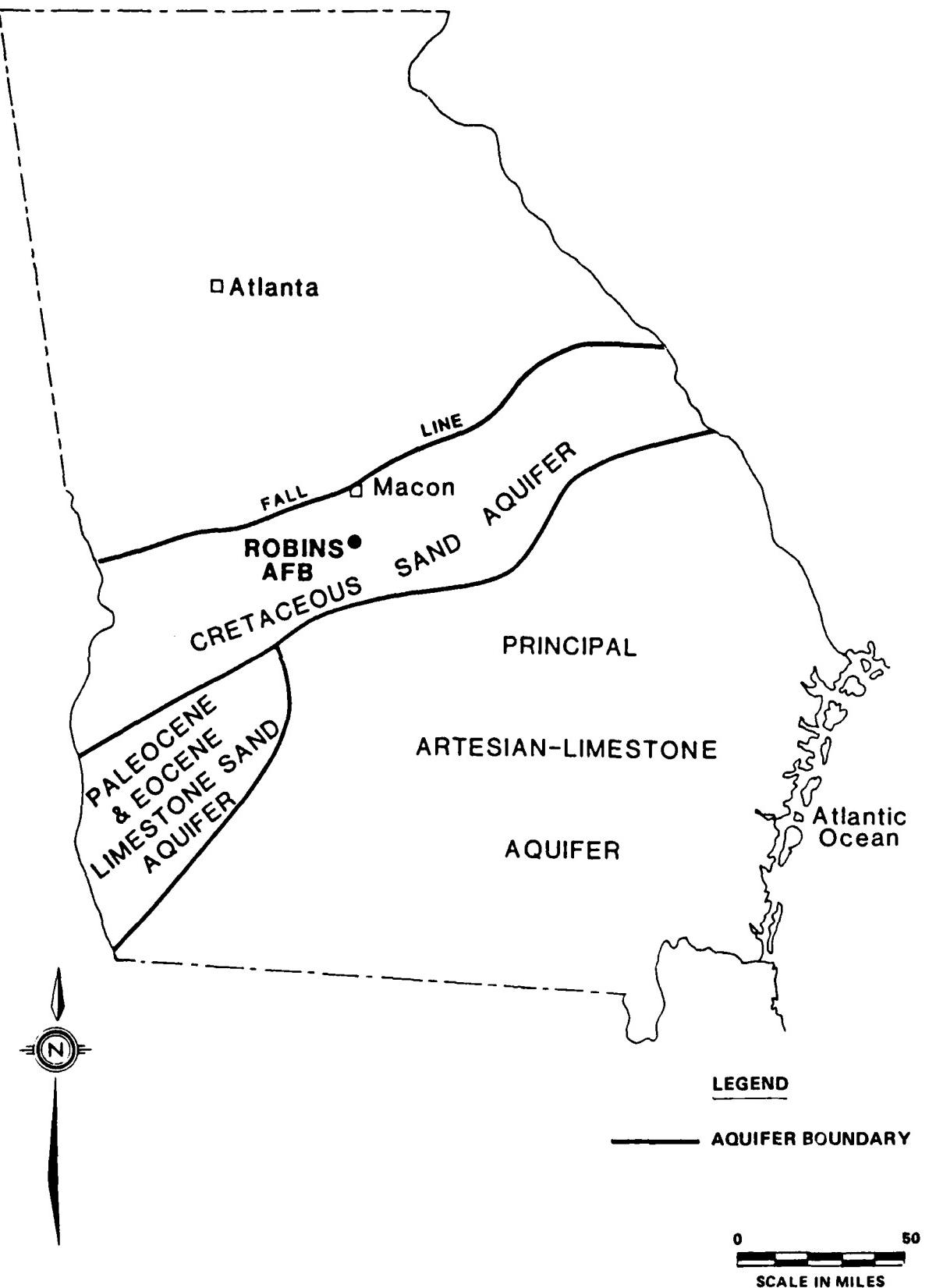


FIGURE 17. Principal Aquifers of the Coastal Plain of Georgia

extending to the Ocmulgee River (LeGrand, 1962). There appears to be a confining bed just below the swamp deposits which would create artesian conditions immediately below this upper layer. Both the land surface and the beds are inclined towards the southeast, but the inclination of the beds is steeper. The numerous interbedded clay layers in both the Providence Sand and the Tuscaloosa Formation create artesian conditions within them. Surface water recharge, particularly precipitation, enters the ground, percolates to the water table, and flows downgradient to a point where the zone of saturation is interrupted by an impermeable bed. Part of the water may pass above the bed and continue to flow under water table conditions and the other part of it flows beneath the confining bed. This is confined or artesian water; it will rise in a tightly cased well to a height above the bottom of the confining bed. The interlayering of clay and sand results in a composite artesian system consisting of several artesian aquifers and intervening clay confining beds.

In the study area, deposits of Cretaceous Age furnish adequate water supplies to present users and are capable of yielding large supplies to future developers. The City of Warner Robins obtains its water from wells screened in various sand layers of the Tuscaloosa Formation. Figure 18 shows the location of these wells and Table 6 gives a brief summary of the wells. The city wells have capacities which range from 1,000 to 1,600 gallons per minute (gpm) indicating the large quantity of water available from this aquifer. Robins AFB has 12 wells; wells WS-1 through WS-8 are used as a drinking water source. Locations and a summary of these wells are given in Figure 19 and Table 7. Well WS-9 furnishes water supplies to the Federal Aviation Administration (FAA) building. Well WS-12 is used for water level maintenance at Luna Lake.

2.4.1 Groundwater Quality

Groundwater flow direction in the Cretaceous Sand Aquifer is in an easterly to southeasterly direction (LeGrand, 1962), discharging locally

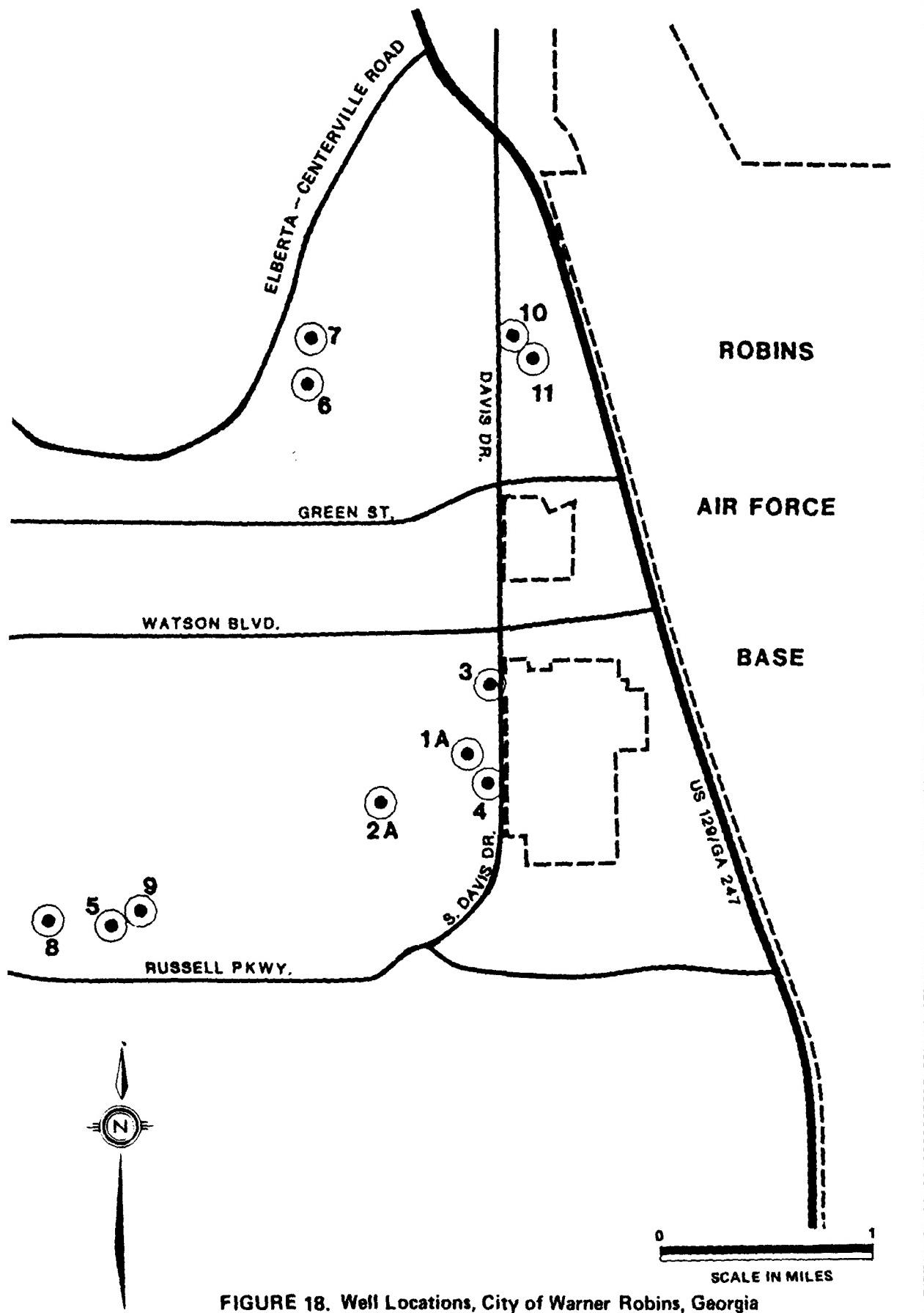


FIGURE 18. Well Locations, City of Warner Robins, Georgia

SOURCE: City of Warner Robins, Water Department Documents, 1981
2-17 (as depicted in Schroeder et al., 1982).

City of Warner Robins Municipal Wells

Casing Diameter (in.)	Total Depth (feet)	Capacity (gpm)	Static Depth Below Ground Surface (feet)	Motor H.P.	Date Drilled	Remarks
12	540	1,557	129	150	1981	10' screens at 340', 370', and 420' 20' screens at 440', 470', and 510'
25	580	1,613	132	150	1979	10' screens at 174', 300', 478', and 495' 40' screen at 400'
10	415	1,000	105	75	1961	10' screen at 360' 20' screen at 275' 15' screen at 390'
12	390	1,559	122	100	1960	10' screen at 240' and 320' 20' screen at 360'
12	422	1,100	132	75	1962	10' screens at 235' and 270' 20' screen at 392' 5' screen at 349'
12	435	1,050	116	100	1968	10' screens at 250', 390', and 415' 20' screen at 290'
12	440	1,641	105	150	1972	10' screen at 240' 20' screen at 345' 30' screen at 400'
12	430	1,641	101	150	1970	20' screens at 240', 360', and 400' 15' screen at 305'
12	490	1,613	101	150	1971	10' screens at 330' and 405' 20' screens at 360' and 460'
12	480	1,613	56		1976	
12	440	1,600	47	100	1976	

: City of Warner Robins Water Plant Files (as depicted in Schroeder et al., 1982).

0. Presurvey Recommendations for the Phase II, Stage 1 Scope of Work
(Page 1 of 3)

Site	Recommended Actions
Landfill No. 1 Sludge Lagoon	<ol style="list-style-type: none">1. Access in the swamp between Landfill No. 4 and Hannah Road and east of Hannah Road is extremely difficult; therefore, geophysical surveys or well installation in the swamp appear to be impractical and are not recommended.2. Install the following monitor wells:<ul style="list-style-type: none">- One cluster of upgradient wells 25, 50, 75, and 100 feet deep;- Two four-well clusters immediately downgradient of the landfill to depths of 25, 50, 75, and 100 feet;- Two two-well clusters (depths of 25 and 50 feet) between the Sludge Lagoon and the stream north of the lagoon; and- If necessary, replace existing wells W-15 through W-18, but delete replacement of wells W-12 through W-14.3. Sample each monitor well.4. Collect surface water and sediment samples at eight locations along the drainage course from Landfill No. 4 to the base boundary. Collect leachate samples from three locations.5. Analyze water samples for parameters in lists A, B, E, F, G, and K of Table 11. For sediment samples, perform analyses for parameters in lists B, E, and F of Table 11.6. Abandon and seal existing wells W-1 through W-11 in accordance with State of Georgia regulations.
Landfill Site	<ol style="list-style-type: none">1. Collect surface soil samples from six locations.2. Install one monitor well, and collect a groundwater sample from it.3. Analyze all samples for DDT.

Table 9. Analytical Parameters Recommended in the Phase I Report

List A

Samples from:

Groundwater monitoring wells
Leachate
Base water supply wells
Stream sediment samples
Stream water samples

Analyses to include:

GC/MS scan
Total organic carbon
pH
Nickel
Phenol
Cyanide
Copper
Zinc
Manganese
Total dissolved solids
Interim Primary Drinking Water Standards (selected list)

Arsenic	Lead	Endrin	2,4,5-TP Silvex
Barium	Mercury	Lindane	Radium
Cadmium	Nitrate	Methoxychlor	Gross alpha
Chromium	Selenium	Toxaphene	Gross beta
Fluoride	Silver	2,4-D	

List B

Samples from:

Groundwater monitoring wells
Water extract of soil borings

Analyses to include:

Interim Primary Drinking Water Standards (see above list)
pH
Total organic carbon
Nickel
Phenol
Cyanide
Copper
Zinc
Manganese
Total Dissolved Solids

Source: Schroeder et al., 1982.

Table 8. Phase I Recommendations for Phase II Investigations (Page 4 of 4)

Site	Recommended Monitoring	Comments
Laboratory Chemical Disposal Site	Utilize geophysical survey techniques to locate site. If site is identified, collect soil boring as described for Fire Protection Area No. 2.	Unable to determine location of this site. Geophysical survey may be able to detect metal containers.
Water Supply Wells	Conduct a water sample collection and analyses program for water supply wells Nos. 3, 6, 8, and 12. The parameters shown in List A of Table 9 should be used for analyses of each sample.	
Surface Water Monitoring	Sample water and sediments of the drainage courses from Landfill No. 4 to the base boundary. Set up approximately eight sampling stations and analyze for the parameters in List A, Table 9.	

Source: Schroeder et al., 1982.

Table 8. Phase I Recommendations for Phase II Investigations (Page 3 of 4)

Site	Recommended Monitoring	Comments
Landfill No. 1	<ul style="list-style-type: none"> a. Conduct geophysical survey in the area in and around Landfill (approximately 15 to 20 acres). If geophysical survey techniques do not work, then install six monitoring wells into the top of the water table downgradient of the site (about 10 to 20 feet deep). Sample for floating material. b. Collect surface water samples of leachate stream(s). Analyze for parameters in List A, Table 9. 	JP-4 spill (1965) occurred around Landfill No. 1. Therefore, monitoring of these sites should be performed jointly.
Landfill No. 2	Establish shallow groundwater quality monitoring system in uppermost aquifer, consisting of one upgradient and three downgradient wells. Construct wells of PVC (Schedule 40) and monitor for parameters in List A, Table 9.	
JP-4 Spill (1965)	Conduct monitoring as described under Landfill No. 1.	Should monitor with Landfill No. 1, since they are in the same area.
Hazardous Waste Burial Site	Establish shallow groundwater quality monitoring system in uppermost aquifer, consisting of one upgradient and two downgradient wells. Construct wells of PVC (Schedule 40) pipe and monitor for parameters in List B, Table 9.	
Fire Training Area No. 1	Monitoring will be included as part of monitoring program at Landfill No. 2.	

Table 8. Phase I Recommendations for Phase II Investigations (Page 2 of 4)

Site	Recommended Monitoring	Comments
Landfill No. 4	<ul style="list-style-type: none"> - If possible, establish a line of monitoring wells along edge of farthest plume extent. Construct and monitor for parameters in List A, Table 9. - If contamination is determined to exist at depths of 100 feet, increase monitoring depth in order to determine maximum depth of contamination. Monitor for parameters specified in List A, Table 9. 	<p>Landfill No. 4 and the sludge lagoon are too close to monitor separately.</p>
Sludge Lagoon	<p>Monitoring program described under Landfill No. 4 will include the sludge lagoon.</p>	
DDT Spill (1979)	<p>Monitor soil samples for DDT to verify cleanup of the site.</p>	<p>Preliminary monitoring has indicated DDT contamination. The soil in the spill area should be removed and replaced with fill material, then pave over the site.</p>
Fire Protection Area No. 2		<p>Collect soil borings in and around the suspected area of the old pits (100 feet by 200 feet, 15 in the pit area and one outside the area). The borings should be on 500-foot grid, 10 feet deep, and soil samples taken at regular intervals and at any interface. Analyses should be performed on water extractions, and analyzed for the parameters in List B, Table 9.</p>

Table 8. Phase I Recommendations for Phase II Investigations (Page 1 of 4)

Site	Recommended Monitoring	Comments
Landfill No. 4	<p>a. Utilize geophysical survey techniques to map contaminant plume, if site geology permits.</p> <p>b. Establish a revised groundwater monitoring program to determine configuration, depth of contamination, and concentrations of contaminants. Monitoring program should consist of:</p> <ul style="list-style-type: none"> - Evaluate existing downgradient monitoring wells along Hannah Road to determine condition. Continue use if well condition is adequate. - Abandon and seal (per Section 391-3-2-.13 of the Ground Water Use Act of 1974) upgradient well and landfill perimeter wells. - Establish new upgradient well, west of Landfill No. 4, at depths of 25, 50, 75 and 100 feet. Monitor for parameters in List A, Table 9. - Establish eight monitoring wells downgradient at landfill perimeter capable of sampling to depths of 25, 50, 75, and 100 feet. Construct wells of stainless steel or Teflon®. Monitor for parameters in List A, Table 9. - If condition permits, use LETCO Hannah Road wells to monitor shallow groundwater quality. If well condition is poor, replace wells with stainless steel or Teflon®. Monitor for parameters in List A, Table 9 - Establish wells in deeper zones along Hannah Road, to depths of 50, 75, and 100 feet. Analyze for parameters in List A, Table 9. 	<p>Geophysical survey performance may be degraded by site geology and wetland environment.</p> <p>Contamination of the shallow aquifer downgradient of this site has been documented by previous groundwater monitoring (LETCO, 1980).</p> <p>This recommended monitoring program is more extensive than confirming if contamination exists. It is intended to define the extent of contamination and help determine remedial action.</p>

Geophysical survey techniques were also recommended for definition of the extent of the JP-4 contamination near Landfill No. 1 and for locating the Laboratory Chemical Disposal site which was reported to be near the dog kennels, south of Luna Lake. The method recommended for locating Fire Protection Training Area No. 2 involved drilling 15 10-foot deep soil borings on 50-foot centers in the area shown in Figure 6 and one such boring outside of the area indicated for Fire Protection Training Area No. 2 (Schroeder et al., 1982).

Phase I recommendations for detecting migrating contaminants at other sites involved monitor well installation, sample collection (groundwater, surface water, leachate, soils, and sediment), and sample analysis as explained in Tables 8 and 9.

3.1.2 Phase II Presurvey Recommendations

After reviewing the Phase I report and inspecting the study sites, WAR developed recommendations for the Phase II, Stage 1 scope of work that differed in several respects from those presented in the Phase I report (WAR, 1982). WAR's recommendations are summarized in Tables 10 and 11. Table 10 summarizes the recommendations and contains cross-references to the list of analytical parameters in Table 11.

Recommendations in the Phase II presurvey report emphasized techniques for detection of migrating contaminants instead of techniques for delineating a potential leachate plume from Landfill No. 4 or the JP-4 plume in the vicinity of Landfill No. 1. Site access was the primary limitation in the use of geophysical survey techniques in the swampy area east of Landfill No. 4. This area is a river floodplain swamp with dense vegetation, flooded conditions, and soft organic soils. Estimated costs for using geophysical survey techniques downgradient of Landfill No. 4 were \$150,000 for road construction through the swamp and \$34,200 for the survey (WAR, 1982). These costs plus the uncertainty about the existence of a well-defined plume from Landfill No. 4 (LETCO, 1980) made a geophysical survey unattractive.

3.0 FIELD PROGRAM

3.1 DEVELOPMENT OF THE FIELD PROGRAM

Definition of the present scope of work proceeded in three steps. The initial step came at the conclusion of the Phase I records search study with recommendations for further work by Schroeder et al. (1982).

Subsequently, the USAF Occupational and Environmental Health Laboratory (OEHL) assigned WAR the task of performing the Phase II presurvey for Robins AFB. This involved reviewing the Phase I report, inspecting the sites at Robins AFB, preparing WAR's recommendations for the Phase II, Stage 1 study, and preparing cost estimates of both the Phase I recommendations and WAR's recommendations (WAR, 1982). OEHL reviewed the Phase II presurvey report and developed the present scope of work (Appendix E).

3.1.1 Phase I Recommendations

Schroeder et al. (1982) recommended field confirmation work at all of the sites described in Section 1.3 of this study plus the Laboratory Chemical Disposal site and sampling and analysis of surface water in drainage courses from Landfill No. 4 to the base boundary. Table 8 lists the Phase I recommended monitoring actions, and Table 9 contains recommended analytical parameters referenced in Table 8.

In general, the Phase I recommendations were designed to define the extent of contamination at some sites (Landfill No. 4, Sludge Lagoon, and JP-4 Spill site), to determine the location of others (Fire Protection Training Area No. 2 and Laboratory Chemical Disposal site), and to determine if contaminants were migrating from each of the sites.

Recommendations for definition of the extent of contamination at Landfill No. 4 and the Sludge Lagoon included geophysical surveys confirmed by installation of vertical clusters of monitor wells. Schroeder et al. (1982) also recommended abandonment of damaged LETCO-installed wells in accordance with Section 391-3-2.13 of the Georgia Ground Water Use Act of 1974 and replacement of wells which had to be abandoned and sealed by constructing new wells of stainless steel or Teflon® components.

3.0 FIELD PROGRAM

swampy area. In the western part of the base, the surface soils are sandy and infiltration of precipitation is expected to be high. This infiltration may directly recharge the shallow aquifer.

- o The primary regional aquifer, the Cretaceous Sand Aquifer, underlies Robins AFB and extends to a depth of approximately 650 feet below the surface. It consists of sand with a few clay lenses which act as localized confining beds interspersed throughout its thickness.
- o Robins AFB obtains its water supply from 12 wells distributed over the installation. The City of Warner Robins, hydraulically upgradient of Robins AFB, has a separate system consisting of 11 wells, located throughout the city. All wells are drilled into the Tuscaloosa Formation of the Cretaceous Sand Aquifer.
- o Recharge for the Cretaceous Sand Aquifer occurs west of Robins AFB where the Providence Sand outcrops at the surface. Some recharge may also occur beneath the base as some interconnection between alluvial and underlying deposits may occur.

From these major points, it may be seen that the potential for the generation and migration of contamination caused by past waste disposal practices is high. The presence of shallow groundwater contaminants has been documented near Landfill No. 4 (LETCO, 1980). Although the production wells located on the base are several hundred feet deep, some degree of interconnection between upper and lower aquifers could exist. Information obtained from base production wells and from groundwater monitoring data (LETCO, 1980) indicate that the eastern portion of the base is located in a groundwater discharge area (i.e., the vertical hydraulic gradient is upward). However, the production wells will alter this gradient within their particular zone of influence and may induce the downward movement of leachate. On the eastern edge of the base, some migrating contaminants may be transported in shallow groundwater flow and discharged at the surface into the swamp.

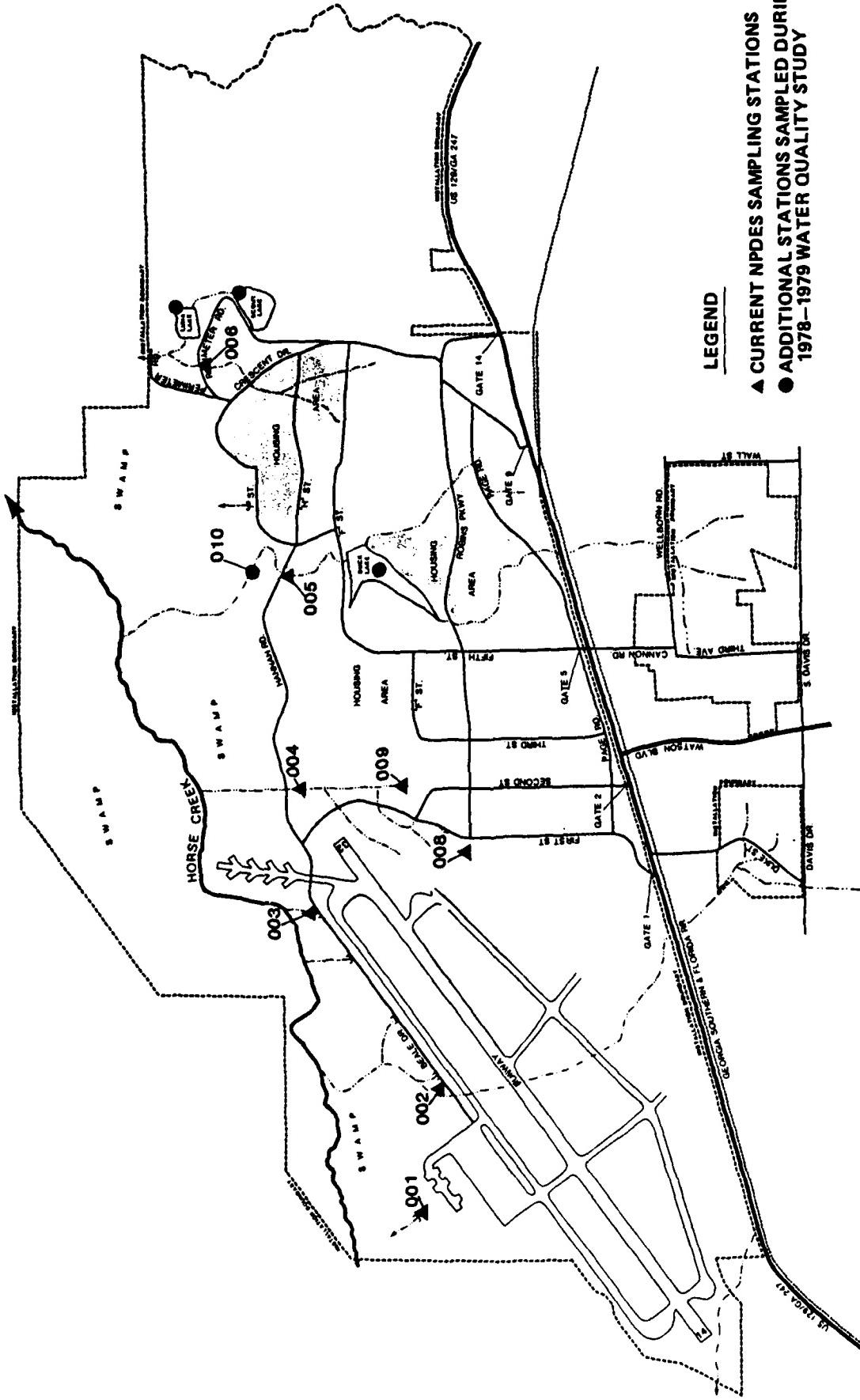
SOURCE: Robins AFB Installation Documents
(as depicted in Schroeder et al., 1982).

FIGURE 20. Surface Water Quality Monitoring Stations Locations, Robins Air Force Base, Georgia



- ▲ CURRENT NPDES SAMPLING STATIONS
● ADDITIONAL STATIONS SAMPLED DURING
1978-1979 WATER QUALITY STUDY

LEGEND



to the Ocmulgee River. Natural groundwater quality in the Cretaceous Sand Aquifer has been reported to be excellent based upon analyses for mineral content (LeGrand, 1962). Results from groundwater samples collected in January 1978 indicated the quality to be excellent with very little mineral content. Results did not indicate any contamination of these wells for the parameters tested; however, an organic scan was not run.

2.5 SURFACE WATER QUALITY

Robins AFB has several streams and surface drainage systems which originate on or flow through the base property. All of these streams drain in a general west-to-east course and ultimately flow to the Ocmulgee River either via defined creek beds such as Horse Creek or by dissipated overland drainage through the adjacent swamp areas. The streams have been monitored routinely at several locations by the base BES in compliance with state permit requirements. In addition to the required monthly sampling program, BES conducted a baseline chemical characterization survey of the nonpotable surface waters within the base between 1978 and 1979 (Talley et al., 1979). Figure 20 depicts the surface water monitoring stations presently sampled for National Pollutant Discharge Elimination System (NPDES) permit compliance as well as the additional stations sampled during the 1978/1979 baseline survey. Summaries of the data compiled during the 1978/1979 study and the 1981 NPDES data are included in Appendix D.

2.6 SUMMARY OF ENVIRONMENTAL SETTING

The environmental setting information reviewed for this study indicate the following key items concerning the impact of past waste disposal practices on the base:

- o Alluvial deposits cover the upper 20 to 40 feet of the base. The eastern part of the base is swampy with peat deposits covering the upper 10 to 15 feet and underlain by a thin layer of clay. The western part of the site consists of more sandy alluvial deposits which extend eastward below the swamp deposits.
- o The water table beneath the base is shallow, particularly to the east where a surface discharge contributes to the creation of a

Table 7. Summary of Robins AFB, Georgia Wells

Bldg. No.	Well No.	Casing Diameter	Feet Depth	Capacity (gpm)	Original Static Level	Motor H.P.	Pump Type	Date Drilled	Remarks
186	1	12"	362	835	100	Vertical turbine	1941	Redrilled	
	1A	12"	389	950					
164	2	12"	255	900	100	Vertical turbine	1941	Redrilled	
	2A	12"	386	900					
	3	12"	298	1,300					
648	4	12"	430	775	60	60	1943	1956	
	4A	12"	385	992					
511	5	12"	355	700	45'	100	1942	1963	
	5A	12"	430	1,230					
	6	12"	367	1,500		150	1943	1974	Redrilled
	6A	12"	495	1,500		63'	1944	1976	
	7						1944	1976	
	7A	12"	490	992		100	1944	1976	Redrilled
	8	8"	522	900		75	1944	1976	
61	9	6"	140	30	60'	3	Submersible	1958	
	9A	—	135	300		7.5	Submersible	1970	6" outlet
	10	(Small well—data unavailable)							
	11		180	10	45'	1	Jet pump	1968	2" outlet
	12			20		1	Submersible	1966	4" outlet

Note: The A notation after the well number indicates that the well was redrilled.

Source: Robins AFB Files (as depicted in Schroeder et al., 1982).

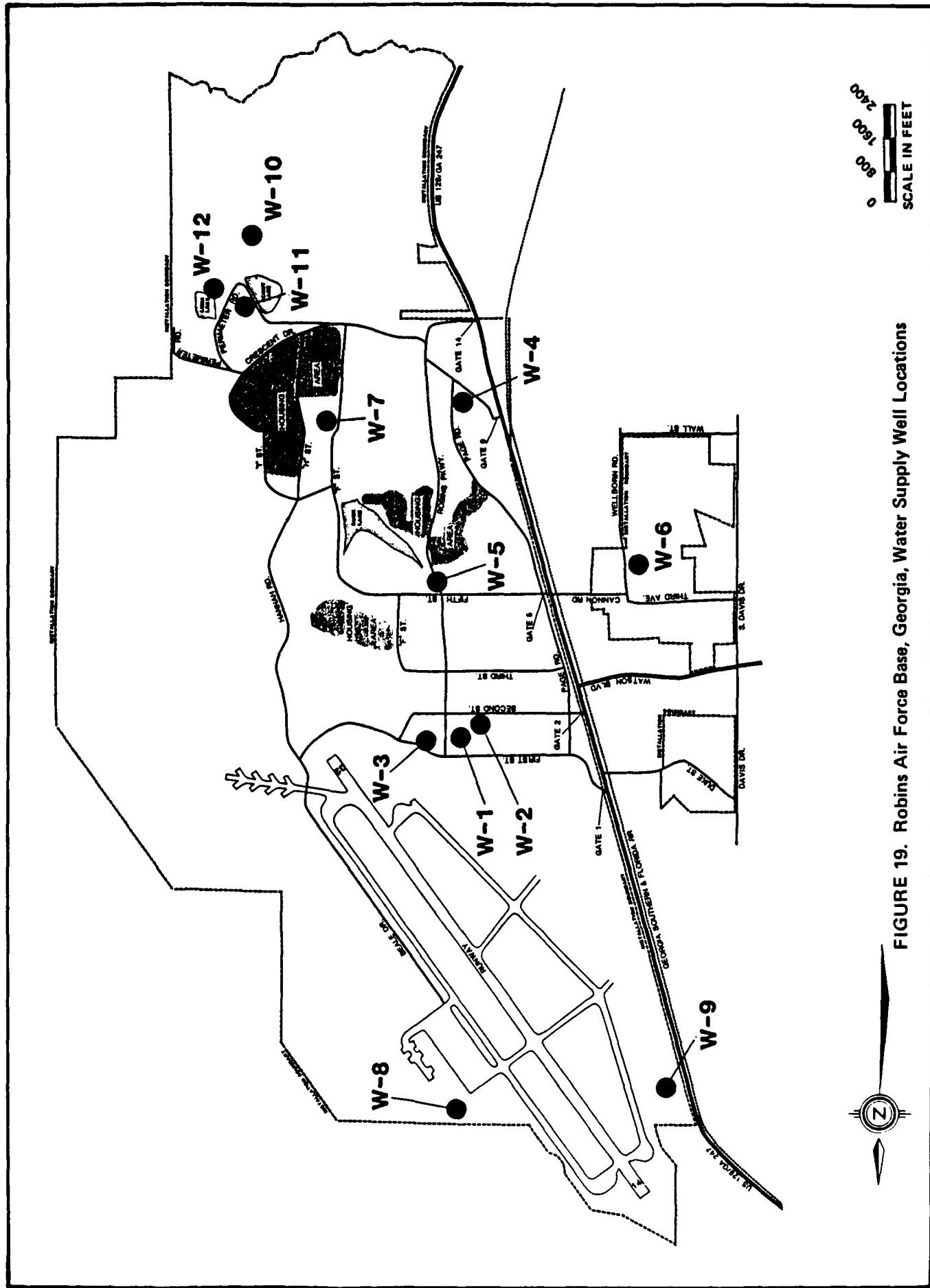


FIGURE 19. Robins Air Force Base, Georgia, Water Supply Well Locations

SOURCE: Robins AFB Installation Documents
(as depicted in Schroeder et al., 1982).

Table 10. Presurvey Recommendations for the Phase II, Stage 1 Scope of Work
 (Page 2 of 3)

Site	Recommended Actions
Fire Protection Training Area No. 2	<ol style="list-style-type: none"> 1. Install two monitor wells into the shallow aquifer (approximately 75 feet). 2. Sample the two monitor wells plus existing water supply wells WS-11 and WS-12. 3. Analyze all water samples for parameters in lists A, C, and J of Table 11.
Landfill No. 1 and JP-4 Spill Site	<ol style="list-style-type: none"> 1. Geophysical survey techniques may not be effective in defining the JP-4 plume. Due to the high cost of performing such a survey, it is not recommended. 2. Install six monitor wells into the top of the shallow aquifer downgradient of the site. 3. Sample the six monitor wells and up to three seeps from the landfill. 4. Analyze samples for parameters on lists A, B, E, and F of Table 11.
Landfill No. 2 and Fire Training Area No. 1	<ol style="list-style-type: none"> 1. Install one well upgradient and three wells downgradient of Landfill No. 2 2. Sample the groundwater in each well, and collect three surface water/leachate samples from the site. 3. Analyze the samples for parameters in lists A, B, E, F, and H of Table 11.
Hazardous Waste Burial Site	<ol style="list-style-type: none"> 1. Install one upgradient and two downgradient monitor wells. 2. Collect groundwater from the wells and analyze the samples for DDT, PCBs, and mercury.
Laboratory Chemical Disposal Site	<ol style="list-style-type: none"> 1. Use geophysical survey techniques to locate the site. 2. If the geophysical survey is successful, install two monitor wells into the shallow aquifer at the site. 3. Sample the monitor wells and existing water supply wells WS-11 and WS-12.

Table 10. Presurvey Recommendations for the Phase II, Stage 1 Scope of Work
(Page 3 of 3)

Site	Recommended Actions
Laboratory Chemical Disposal Site	4. Analyze the samples for parameters in lists A, D, E, and K of Table 11.
Water Supply Wells	1. Sample water supply wells WS-3, WS-6, WS-8, and WS-12. 2. Analyze these samples for parameters in lists A, B, D, E, J, and K of Table 11.

Source: WAR, 1982.

Table II. WAR Recommended List of Analytical Parameters

List	Parameters
A	GWCI--TOC, TOX, Specific conductance, pH
B	Metals--As, Ba, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Zn
C	Total Pb
D	Anions--NO ₃ , F, total cyanides
E	Phenolics--Colorimetric method for phenolic compounds
F	Oil and grease
G	Purgeable Organics--ECD detectable compounds stripped from solution by helium at ambient temperature
H	Organophosphate pesticides
I	Chlorinated pesticides
J	Volatile Hydrocarbons--Purgeable compounds commonly found in fuel
K	Base/Neutral Extractables--As per priority pollutant listings analyzed on GC/MS
L	EP Toxicity Procedure--Elutriate test for leachable substances

ECD = Electron capture detector for gas chromatography.

GWCI = Groundwater contamination indicators.

Source: WAR, 1982.

As recognized in the Phase I report, geophysical techniques may not be effective in locating and delineating a plume of JP-4. JP-4 does not disrupt the soil structure in a manner which would render it detectable by seismic refraction or ground-penetrating radar (GPR), nor does it have the distinctive electrical properties (i.e., high ionic strength, relative to ambient groundwater) that make resistivity and electromagnetics successful in locating leachate plumes with such properties. This view was reinforced by a consultant experienced in the use of geophysical survey techniques at hazardous waste sites (Rizzo, 1982); therefore WAR did not recommend use of such techniques at the JP-4 Spill site.

Recommendations for all of the sites emphasized detection of migrating contaminants through sampling and analysis of groundwater, surface water, leachate, sediment, or soils. At Landfill No. 4, detection of potential vertical migration of contaminants through the use of vertical cluster wells received special emphasis.

Cost estimates for well installation at Landfill No. 4 included options for use of stainless steel casing and screen or PVC casing and screen. Well installation at other sites was costed on the basis of PVC casing and screen.

3.1.3 Phase II, Stage 1 Scope of Work

OEHL developed the present scope of work (Appendix E) following its review of the Phase II presurvey report. The scope of work followed the recommendations of the presurvey by selecting techniques which can detect pollutants but cannot define a leachate plume. In addition, there were some variations in the number of wells, number of samples, and analyses. Table 12 lists the sampling and analysis schedule for the present study.

The Phase II, Stage 1 scope of work did not include abandoning and sealing damaged wells at Landfill No. 4. PVC well casing and screen were specified for all study sites.

Table 12. Schedule of Samples for Phase II, Stage 1 Study Sites, Robins AFB, Georgia

Study Site	pH	Sp. Cond.	TOX	DOC	Purgeable Organics	Pesticides*	DDT	PCBs	Phenolics	Cyanide	Heavy Metals	Oil & Grease	Organic Priority Pollutants
ZONE 1—LANDFILL NO. 4 AND SLUDGE LAGOON													
Groundwater	17	17	17	6						17	17	17†	
Surface water	4	4	4	1						4	4	4†	
Sediment				1						3	3	3†	
Leachate	1	1		1									
ZONE 2—DDT SPILL SITE													
Groundwater	1	1											
Soil										1** 4**			
ZONE 3—FIRE PROTECTION TRAINING AREA NO. 2													
Groundwater	4	4	4	4	4	4				2	2	2††	
ZONE 4—LANDFILL NO. 1 AND JP-4 SPILL SITE													
Groundwater	5	5	5	5	5	1				5	5	5	
Leachate	3	3	3	3	3	1				3	3	3†	
ZONE 5—LANDFILL NO. 2 AND FIRE TRAINING AREA NO. 1													
Groundwater	3	3	3	3	3	3				3	3	3†	
Surface water	3	3	3	3	3	3				3	3	3†	
ZONE 6—HAZARDOUS WASTE BURIAL SITE													
Groundwater	1	1								1	1	1***	
WATER SUPPLY WELLS 3, 6, and 8													
Groundwater	3	3	3	3	3	3				3	3	3†	
													1

*Aldrin, DDT isomers, dieldrin, endrin, heptachlor, heptachlor epoxide, lindane, methoxychlor, diazinon, malathion, parathion, 2,4-D, 2,4,5-T, and silvex.

†Cadmium, copper, chromium, lead, nickel, and zinc.

**The list of analyses for Zone 2 was subsequently expanded to include aldrin, DDT isomers, dieldrin, endrin, heptachlor, heptachlor epoxide, lindane, methoxychlor, and chlordane.

†Lead.

**Mercury.

3.2 IMPLEMENTATION OF THE FIELD PROGRAM

3.2.1 Monitor Well Installation

Monitor well construction at the Phase II, Stage 1 study sites presented several unusual problems:

- o Reported degradation (solvent damage) of the existing wells at Landfill No. 4 (LETCO, 1980; Schroeder et al., 1982).
- o Siting requirements for wells LF4-3 through LF4-12 were such that these wells would penetrate zones of known contamination as well as an underlying confining bed.
- o The requirement to install several wells 30 to 100 feet into saturated sands meant that the hollow-stem auger (HSA) drilling technique could not be used for these wells. WAR's experience has shown that drilling more than 10 feet into saturated sands with HSA results in sand flowing into the HSA, which prevents both collection of representative samples and installation of well casing and screen through the HSA.

Solutions to these problems required varying techniques and materials in well design.

At the start of fieldwork, WAR determined that clay and silt now fill wells W-2 through W-6 (Figure 6) from approximately the top of the PVC well screen to the bottom of the well. Since this is consistent with solvent-damaged PVC well screens, WAR and OEHL conferred and decided to use stainless steel well screen with 5 feet of stainless steel casing topped by PVC casing in well LF4-3 through LF4-12 (Figure 5).

The solution to the second problem involved installation of pit casings at all wells in the immediate vicinity of Landfill No. 4 and the Sludge Lagoon. In this case, pit casings consisted of 8-inch [inside diameter (ID)] black iron pipe, centered and grouted in a 12-inch borehole which extended into but not through the underlying confining bed. As described below, conditions encountered at Fire Protection Training Area No. 2 made

it desirable to install a pit casing at one of the two wells at this site also.

Since it was impractical to use the HSA drilling method for all wells, WAR used hydraulic-rotary drilling techniques at wells LF4-1 through LF4-13 and at well FPT2-2. The HSA method was used in all other wells. Thus, there were two basic monitor well designs employed during the Phase II, Stage 1 study at Robins AFB; one design with a pit casing and one without. Construction of individual wells proceeded in the following manner:

1. Installation of the pit casing, where required.
2. Drilling a 6-inch borehole to the depth specified in Appendix E or to a depth based on field data. Representative lithologic samples were collected by ASTM D-1586-67 at least every 5 feet for preparation of the lithologic log (Appendix F). In wells drilled using hydraulic rotary techniques, only clean, potable water and bentonite were used in mixing the drilling fluid; no other drilling fluid additives were used.
3. A string of clean, threaded, flush-joint, 2-inch well casing and screen (Tri-Loc®) was installed in the borehole. Well screen slot size was 0.010-inch in all wells. Straightness and alignment of the well string was checked periodically in this and in the following well-construction steps.
4. In wells LF4-1 through LF4-13 and FPT2-2, drilling fluid was flushed from the borehole with clean, potable water. Circulation during the flushing operation was down through the casing, out through well screen, and back to the surface via the annular space.
5. Installation of a filter pack of 20-30 sand to approximately 2 to 3 feet above the top of the well screen.
6. Installation of a 1- to 3-foot bentonite seal on top of the filter pack.
7. The remainder of the annular space was filled with a grout consisting of either sand cement (2 parts by weight of sand;

- 1 part by weight of Portland cement; and not more than 7 gallons of clean, fresh water per 94-pound sack of Portland cement) or neat cement (Portland cement mixed with not more than 7 gallons of clean, fresh water per 94-pound sack of Portland cement) (EPA, 1985).
8. A steel protective casing was installed approximately 3 feet into the grout and equipped with a padlock. Aboveground portions of both the well casing and the protective casing were vented to permit free fluctuation of the water level within the well.
 9. Each well was developed until the discharge was clear. Well development techniques were varied, as needed, and included use of a surge block, pumping, and the single-line air lift method (EPA, 1975).
 10. All down-hole tools were thoroughly washed with potable water between holes to prevent cross-contamination. Drill rigs were steam-cleaned before the start of drilling and were washed with potable water as the need arose.

WAR's drilling subcontractor was LETCO of Atlanta, Georgia. Well construction was supervised and inspected by WAR's on-site hydrogeologist. The safety plan (Appendix G) was in force for all field operations.

Indications of contamination were encountered during construction of several wells (see Appendix F, Well Logs). "Fuel" or "solvent" odors were noted during construction of wells LF1-1, LF1-2, LF1-3, LF4-3, LF4-4, LF4-5, LF4-6, FPT2-1, and FPT2-2. Conditions encountered at Fire Protection Training Area No. 2 (Figure 8) deserve special consideration. The scope of work (Appendix E) specified two 75-foot wells for this site; however, during construction of well FPT2-1, the field crew encountered oily wastes in a water-table aquifer. WAR and OEHL discussed this and decided to complete well FPT2-1 in the water-table aquifer and to complete well FPT2-2 in the next lower aquifer. Since well FPT2-2 would

penetrate the confining bed between the water-table aquifer and the underlying artesian aquifer, a pit casing was incorporated in the design of well FPT2-2. A slight "solvent" odor was noted in the water-table aquifer at well FPT2-2, but there was no detectable odor in the underlying artesian aquifer.

The uppermost aquifers at the DDT Spill site and the Hazardous Waste Burial site were perched water-table aquifers. Since potential contaminants from these two sites could most reasonably be expected to be found in the uppermost aquifer beneath the site, WAR completed wells DDT-1 (Figure 7) and HW-1 (Figure 8) in the perched water table.

An Enmet CGS-18M portable gas detector was used during fieldwork at Robins AFB to monitor potential toxic or combustible gas hazards. The toxic gas detector circuit was calibrated to sound an alarm if the concentration of methyl chloride exceeded 200 ppm, and the combustible gas detector circuit was calibrated to sound an alarm if methane exceeded 20 percent of the lower explosive limit. Both detectors respond to gases other than the calibration gases. During the course of the fieldwork, the toxic gas detector sounded an alarm twice, for about 10 seconds each time. The first such event was during construction of well LF4-10; the other was during construction of well LF4-5. Since the alarms were transitory, work continued in both instances. In no instance did the combustible gas alarm sound.

3.2.2 Sample Collection

WAR sampled all Phase II, Stage 1 sites at Robins AFB during December 1983 according to the sample schedule in Table 12. WAR's Quality Assurance/Quality Control (QA/QC) Plan (Appendix H) determined that the analyses for pesticides, purgeable organics, and cyanide had exceeded either holding times or extraction times; therefore, WAR resampled for these parameters in March 1984.

Collection of a groundwater sample from a monitor well followed these steps:

1. Measurement of the depth to water from the top of the casing;
2. Determination of the volume of water contained in the well casing and screen (the well volume);
3. Removing at least five well volumes of water from the well.

Wells in which depth to water was less than 20 feet were purged with a centrifugal pump (Honda WA-15) in both samplings. This included all except four wells (HW-1, DDT-1, FPT2-2, and LF4-13). Wells HW-1 and DDT-1 were purged by bailing (Timco, 5-foot by 1 1/4-inch PVC bailer, no glue) since there was little water in these wells. Wells FPT2-2 and LF4-13 were purged by bailer in December and by a positive displacement, gas-actuated, submersible pump (ISCO®, #2600) in March. Water supply wells (WS-3, WS-6, and WS-8) were purged with the pump installed in the well. Wells purged by centrifugal pump were sampled with bailers with the exception of Wells LF4-1, LF4-2, LF4-3, LF4-5, LF4-7, LF4-8, LF4-10, LF4-12, W-7, W-8, W-15, W-16, W-18, and W-19, which were sampled from the discharge of the centrifugal pump. Wells purged by submersible pump were sampled from the pump discharge. Barcelona et al. (1984) (published after Robins fieldwork was completed) evaluated the effectiveness of groundwater sampling techniques for collection of purgeable and gas-sensitive parameters. Positive displacement submersible pumps received the highest rating, and use of bailers was ranked second. Suction pumps were found to be suitable for purging wells. The findings of Barcelona et al. (1984) indicate that samples collected for analysis of purgeable organics from the discharge of a centrifugal pump (LF4-7 and LF4-8) would tend to give lower-than-actual readings upon analysis.

4. Measurement of specific conductance, temperature, and pH of the last fraction of water removed from the well in Step 3; and

5. Sample collection and preservation followed the procedures described for each sample fraction in Appendix H (Laboratory Methods and QA/QC Plan).

Sampling of surface water and leachate consisted of taking grab samples and measuring specific conductance, temperature, and pH on-site. Due to the thick mat of leaves and other organic material present in the sediment, a spade-point shovel was used to remove the sediment samples after collection of the surface water samples. The sediment was scooped from the shovel blade with the sample container to minimize contamination. Soil samples at Zone 2 were taken with a shovel and precleaned, nylon sampling spoons. The shovel was rinsed between sampling sites with tap water. In December, one nylon sampling spoon was used and was cleaned between sampling sites with tap water. In March, a separate nylon sampling spoon was used for each station.

Field data sheets (Appendix I) record all field measurements, sample bottle numbers, and observations for a given station.

4.0 DISCUSSION OF RESULTS AND SIGNIFICANT FINDINGS

4.0 DISCUSSION OF RESULTS AND SIGNIFICANT FINDINGS

4.1 RELEVANT WATER QUALITY CRITERIA AND STANDARDS

4.1.1 EPA Interim Drinking Water Regulations

Drinking water maximum contaminant levels (mcls) established by these regulations are not directly applicable to groundwater sampled during the Robins AFB Phase II, Stage 1 survey, since the regulations pertain to public water systems. They do, however, provide a means of determining potential adverse effects on deeper potable water supplies downgradient from the shallow groundwaters sampled. Primary and secondary drinking water mcls established by EPA for constituents analyzed on the Robins AFB Phase II, Stage 1 survey are in Table 13.

4.1.2 EPA Water Quality Criteria

EPA has established water quality criteria for 64 toxic pollutants or pollutant categories (EPA, 1980). Criteria are given for freshwater and saltwater aquatic life and human health. A summary of criteria for parameters analyzed in the Robins AFB Phase II, Stage 1 survey is given in Table 14. Criteria for saltwater aquatic life are not listed in Table 14 since there are no saltwater systems impacted by disposal sites at Robins AFB.

Human health criteria are derived from animal toxicity data and are given as ambient criteria for noncarcinogenic pollutants, and concentrations estimated to cause a specified level of incremental cancer risk for carcinogens. Human health criteria assume that lifetime intake of the pollutant comes from two sources: (1) drinking an average of 2 liters of water per day, and (2) ingesting an average of 6.5 grams of fish per day. Concentrations shown for incremental cancer risk in Table 14 indicate those which are estimated to cause a lifetime carcinogenic risk of 10^{-6} , or one cancer in a population of 1 million. These concentrations are conservative (low) and are often well below analytical detection limits. Methods for determining human health criteria are discussed in detail by EPA (1980).

13. Relevant EPA MCLs for Drinking Water

Parameter	MCL Established by EPA Interim Drinking Water Standards
Primary Standards, ug/l	
Chromium	10
Manganese	50
Nitrates	50
Lead	2
<u>NATED HYDROCARBONS</u>	
Aromatic hydrocarbons	0.2
Acetone	4
Tetrachloroethylene	100
<u>OPHENOXYS</u>	
Dinitrophenol	100
2,4,5-TP Silvex	10
Trihalomethanes*	100
Secondary Standards (ug/l except for pH)	
Chloride	1,000
Sulfate	300
Chloride	5,000
pH	
6.5 - 8.5	

* of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform), trichloromethane (chloroform).

Source: EPA National Interim Drinking Water Regulations, 40 CFR 143.

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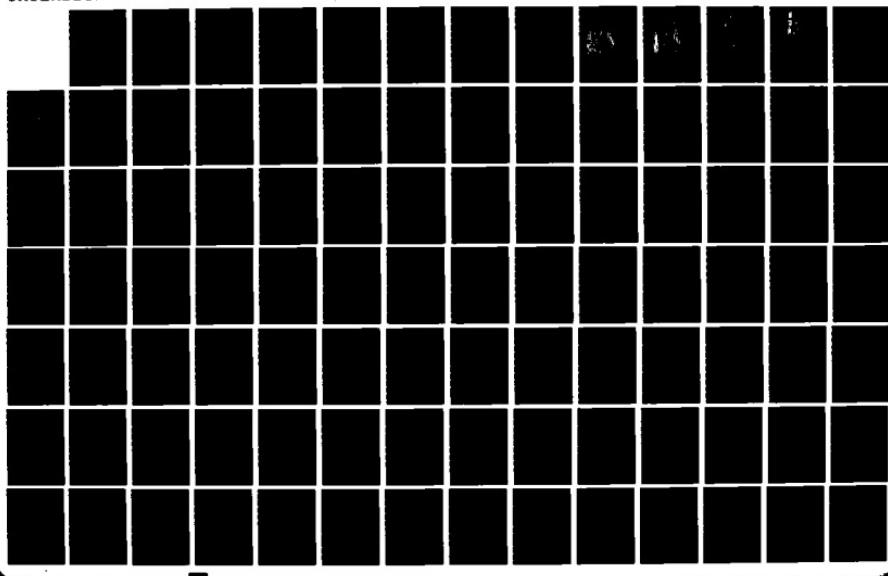
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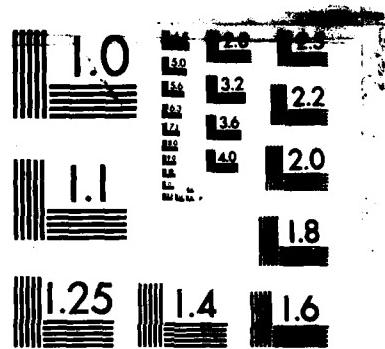
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NATIONAL BUREAU OF STANDARDS-1963-A

Table 14. Relevant EPA Water Quality Criteria (Page 1 of 5)

Parameter	Criteria for Freshwater Aquatic Life, ug/l						Human Health Criteria, ug/l		
	Acute Toxicity		Chronic Toxicity		24-hr. Maximum Concentration		Potable Water Taste/Odor Control†	Ambient Criterion	10^{-6} Incremental Cancer Risk
	Level*	Level*	Average Level*	Maximum Average	Concentration	Control†			
PURGEABLE ORGANICS									
Acrolein	68	21					320	0††	0.058
Acrylonitrile	7,550	2,600**						0††	0.66
Benzene	5,300							0††	0.40
Carbon tetrachloride	35,200								
Chlorinated ethanes									
1,1-dichloroethane	118,000	20,000						0††	0.94
1,1,2-trichloroethane		9,400						0††	0.60
1,1,2,2-tetrachloroethane		2,400						0††	0.17
1,1,1-trichloroethane									
Chloroalkyl ethers	238,000								
bis-(chloromethyl)-ether									
Chloroform	28,900	1,240						0††	0.38 X 10 ⁻⁶
Dichloroethylenes	11,600							0††	0.19
1,1-dichloroethylene									
Dichloropropanes	23,000	5,700							
Dichloropropenes	6,060	244							
Ethylbenzene	32,000							0††	0.033
Haloethers	360	122							
Halomethanes	11,000								
Tetrachloroethylene	5,280	840							
Toluene	17,500								

Table 14. Relevant EPA Water Quality Criteria (Page 2 of 5)

Parameter	Criteria for Freshwater Aquatic Life, ug/l					Human Health Criteria, ug/l			Ingestion of Water and Aquatic Organisms		
	Acute	Chronic	Maximum	24-hr.	Maximum	Portable Water	Taste/Odor	Ambient	10^{-6}	Incremental	
	Toxicity Level*	Toxicity Level*	Average Concentration	Control†	Criterion	Criterion	Criterion	Cancer Risk			
PURGEABLE ORGANICS											
Trichloroethene	45,000	21,900**					0††	2.7			
Vinyl chloride							0††	2.0			
BASE/NEUTRAL EXTRACTABLE ORGANICS											
Acenaphthene	1,700	520**			20		0††	0.00012			
Benzidine	2,500	50***					0††	0.00072			
Chlorinated benzenes	250						0††	1.9			
Hexachlorobenzene	980										
Hexachloroethane	1,600										
Chlorinated naphthalenes											
bis(2-chloroethyl) ether											
bis(2-chloroisopropyl) ether											
Dichlorobenzenes	1,120	763					0††	0.03			
Dichlorobenzidines							34.7				
2,4-dinitrotoluene	330	230					400				
1,2-di phenylhydrazine	270										
Fluoranthene	3,980										
Hexachlorobutadiene	90	9.3					0††	0.0103			
Hexachlorocyclopentadiene	7	5.2					0††	0.11			
Iso phorone	117,000	1					42	0.00042			
Naphthalene	2,300	620					0††	0.45			
Nitrobenzene	27,000						206	5.2			
							30	19.8			

Table 14. Relevant EPA Water Quality Criteria (Page 3 of 5)

Parameter	Criteria for Freshwater Aquatic Life, ug/l						Human Health Criteria, ug/l		
	Acute Toxicity Level*	Chronic Toxicity Level*	Maximum 24-hr. Average	Maximum Concentration	Potable Water Taste/Odor Control	Ambient Criterion	Ingestion of Water and Aquatic Organisms		
							10 ⁻⁶	Incremental Cancer Risk	
<u>BASE/NEUTRAL EXTRACTABLE ORGANICS</u>									
Phthalate esters	940	3					313		
Dimethyl phthalate							350		
Diethyl phthalate							34		
Dibutyl phthalate									
<u>PHENOLIC COMPOUNDS</u>									
<u>CHLORINATED PHENOLS</u>									
4-chloro-3-methoxyphenol			30						
2,3,5,6-tetrachlorophenol									
4-chlorophenol									
3-monochlorophenol							0.10		
4-monochlorophenol							0.10		
2,3-dichlorophenol							0.04		
2,5-dichlorophenol							0.50		
2,6-dichlorophenol							0.20		
3,4-dichlorophenol							0.30		
2,3,4,6-tetrachlorophenol							1.0		
2,4,5-trichlorophenol							1.0		
2,4,6-trichlorophenol							2,600		
2-methyl-4-chlorophenol							2.0		
3-methyl-4-chlorophenol							1,800		
3-methyl-6-chlorophenol							3,000		
2-chlorophenol							20		
2,4-dichlorophenol							0.10		
2,4-dimethylphenol							0.30		
	4,380			2,000**			3.09		
	2,020			365			400		
	2,120								

Table 14. Relevant EPA Water Quality Criteria (Page 4 of 5)

Parameter	Criteria for Freshwater Aquatic Life, ug/l						Human Health Criteria, ug/l		
	Acute Toxicity Level*	Chronic Toxicity Level*	Maximum 24-hr. Average	Maximum Concentration	Potable Water Taste/Odor Control†	10 ⁻⁶ Incremental Criterion	Ingestion of Water and Aquatic Organisms		
							Ambient	Cancer Risk	
PYRETHIC COMPOUNDS									
Nitrophenols	230	150**				30	0.30	1,010	13.4
2,4-dinitro-o-cresol						30	0.30	3.5	70
dinitrophenol									
Pentachlorophenol									
Pheno1									
CHLORINATED HYDROCARBON PESTICIDES									
Aldrin					3.0				0.000074
Chlordane					2.4				0.000046
Dieldrin					2.5				0.000071
DDT					1.1				0.000024
DOE	1,050								
Endrin				0.0023	0.18				0†
Heptachlor				0.0038	0.52				0.00028
Lindane				0.08	2				
Polychlorinated biphenyls	2**			0.014					0†
									.00079
HEAVY METALS									
Cadmium					***				10
Chromium, trivalent	44				***				170,000
Chromium, hexavalent					21				50
Copper					***				1,000

Table 14. Relevant EPA Water Quality Criteria (Page 5 of 5)

Parameter	Criteria for Freshwater Aquatic Life, ug/l					Human Health Criteria, ug/l		
				Ingestion of Water and Aquatic Organisms				
	Acute Toxicity Level*	Chronic Toxicity Level*	Maximum 24-hr. Average	Maximum Concentration	Potable Water Taste/Odor Control†	Ambient Criterion	10^{-6} Incremental Cancer Risk	
HEAVY METALS								
Lead	0.00057	0.0017	***	***	50	50	0.144	
Mercury			***	***			13.4	
Nickel			47	47				
Zinc			3.5	52	5	5		
CYANIDE					200	200		

*Toxicity may occur at lower concentrations among species more sensitive than those tested.
 **Organoleptic data used as basis for taste and odor control have no demonstrated relationship to adverse human health effects.

**Data is not definitive.

†Zero level may not be attainable at this time.

***Maximum level related to hardness of water, for which no data is available.

Source: EPA, 1980.

EPA water quality criteria are intended as guidelines and have no regulatory impact. Ambient criteria provide guidelines for potable water and consumption of aquatic organisms.

4.1.3 State of Georgia Ambient Water Quality Criteria

Georgia Water Quality Regulations (GWQR) contain specific water quality standards only for parameters such as bacteria, solids, dissolved oxygen, pH, and temperature. Standards for these parameters are given for drinking water supplies and all categories of surface waters. Ambient criteria for specific chemical contaminants are not established by GWQR. Chemical contamination of ground and surface water is addressed in the regulations by the following general statement:

"All waters shall be free from toxic, corrosive, acidic, and caustic substances discharged from municipalities, industries or other sources in amounts, concentrations or combinations which are harmful to humans, animals, or aquatic life."

EPA drinking water standards and water quality criteria are applied to drinking water supplies and surface waters within the state to determine what levels of contamination are harmful (Fernstrom, 1984; Winn, 1984).

4.2 RESULTS OF THE PHASE II, STAGE 1 STUDY

Both hydrogeologic data and chemical data were obtained during the present study. The hydrogeologic data include soils descriptions in the well logs (Appendix F) and water level measurements in the monitor wells taken prior to sample collection in December 1983 and March 1984 (Table 15). The concentration of wells in the vicinity of Zones 1, 4, and 5 made it possible to draw groundwater elevation contour maps of the uppermost aquifer in that area (Figures 21 and 22). Well logs in the vicinity were used to draw geologic cross-sections from well LF4-13 to well LF4-1 (Figure 23), from well LFl-1 to well LF4-10 (Figure 24), and from well LFl-4 to well LF2-1 (Figure 25). Orientation of the cross sections is shown in Figure 26. Since there were cluster wells in six locations, it was possible to determine vertical hydraulic gradients

**Table 15. Water Levels in Monitor Wells, Robins AFB, Georgia,
December 1983 and March 1984**

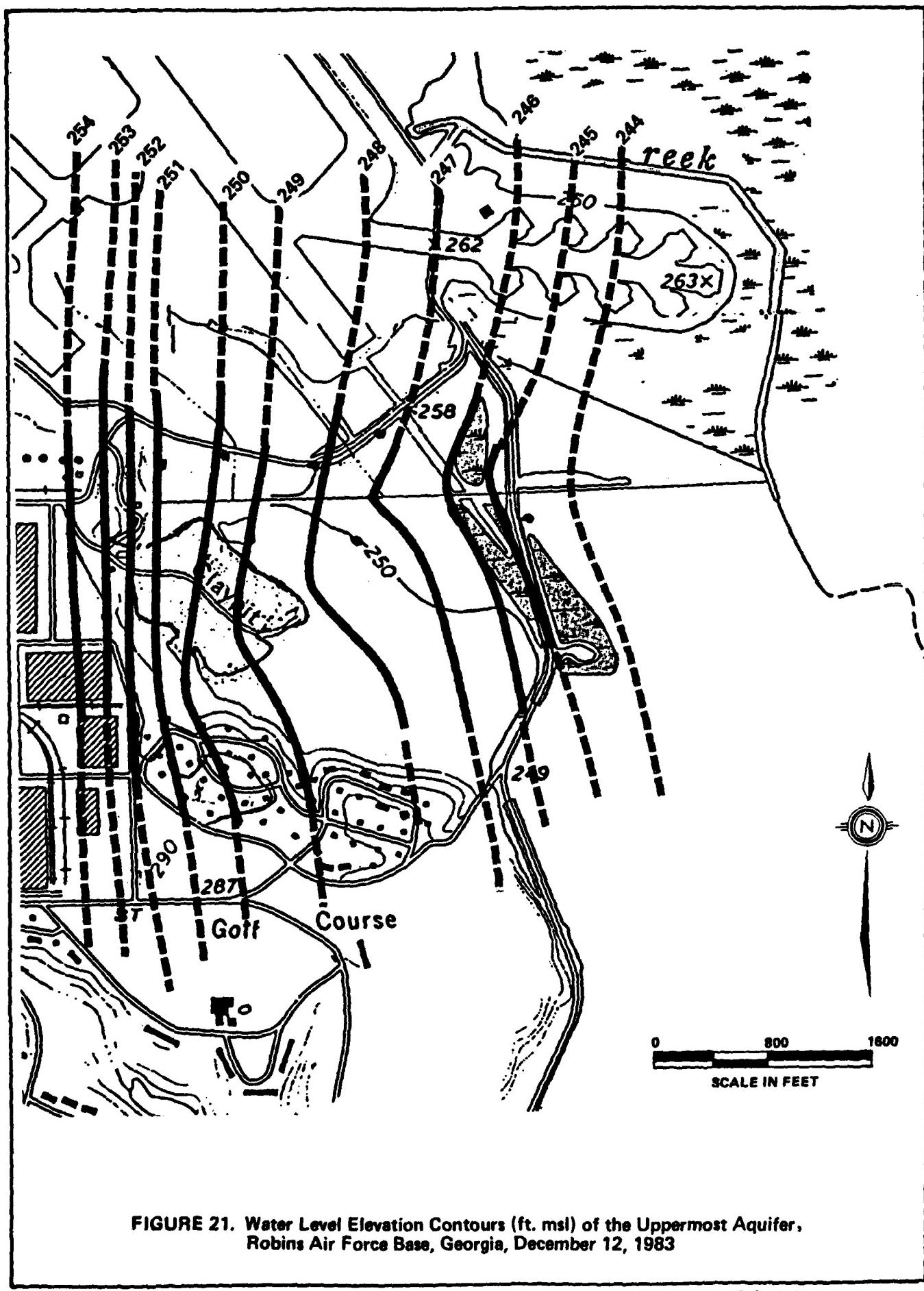
Well	TOC (ft, msl)	December 1983		March 1984	
		DTW (ft)	WL (ft, msl)	DTW (ft)	WL (ft, msl)
HW-1	278.1	27.94	250.16	27.01	251.09
FPT2-1	285.8	9.29	276.51	--	--
FPT2-2	285.9	32.17	253.73	31.82	254.08
DDT-1	308.2	43.98	264.22	38.93	269.27
LF1-1	261.9	8.29	253.61	7.38	254.52
LF1-2	260.9	7.64	253.26	6.85	254.05
LF1-3	260.5	8.71	251.79	6.90	253.36
LF1-4	253.9	2.29	251.61	2.42	251.48
LF1-5	252.5	2.42	250.08	2.03	250.47
LF2-1	257.0	9.46	247.54	8.75	248.25
LF2-2	257.1	8.84	248.26	8.13	248.97
LF2-3	257.3	7.71	249.59	6.93	250.37
LF4-1	249.4	2.34	247.06	1.83	248.57
LF4-2	249.3	4.67	244.63	4.08	245.22
LF4-3	257.4	8.04	249.36	7.42	249.98
LF4-4	257.5	8.27	249.23	7.52	249.88
LF4-5	256.2	7.04	249.16	6.48	249.72
LF4-6	256.5	7.46	249.06	6.89	249.61
LF4-7	251.7	3.42	248.28	2.83	248.87
LF4-8	251.8	3.86	247.94	3.29	248.51
LF4-9	254.0	6.35	247.65	5.56	248.44
LF4-10	252.6	4.04	248.56	3.43	249.17
LF4-11	252.9	5.08	247.82	4.35	248.55
LF4-12	253.2	5.13	248.07	4.60	248.60
LF4-13	294.7	41.00	253.70	38.76	255.94
W-7	254.4	3.84	250.56	3.06	251.34
W-8	256.39	5.29	251.10	4.96	251.43
W-15	251.84	4.75	277.09	4.83	247.01
W-18	252.10	--	--	4.92	247.27

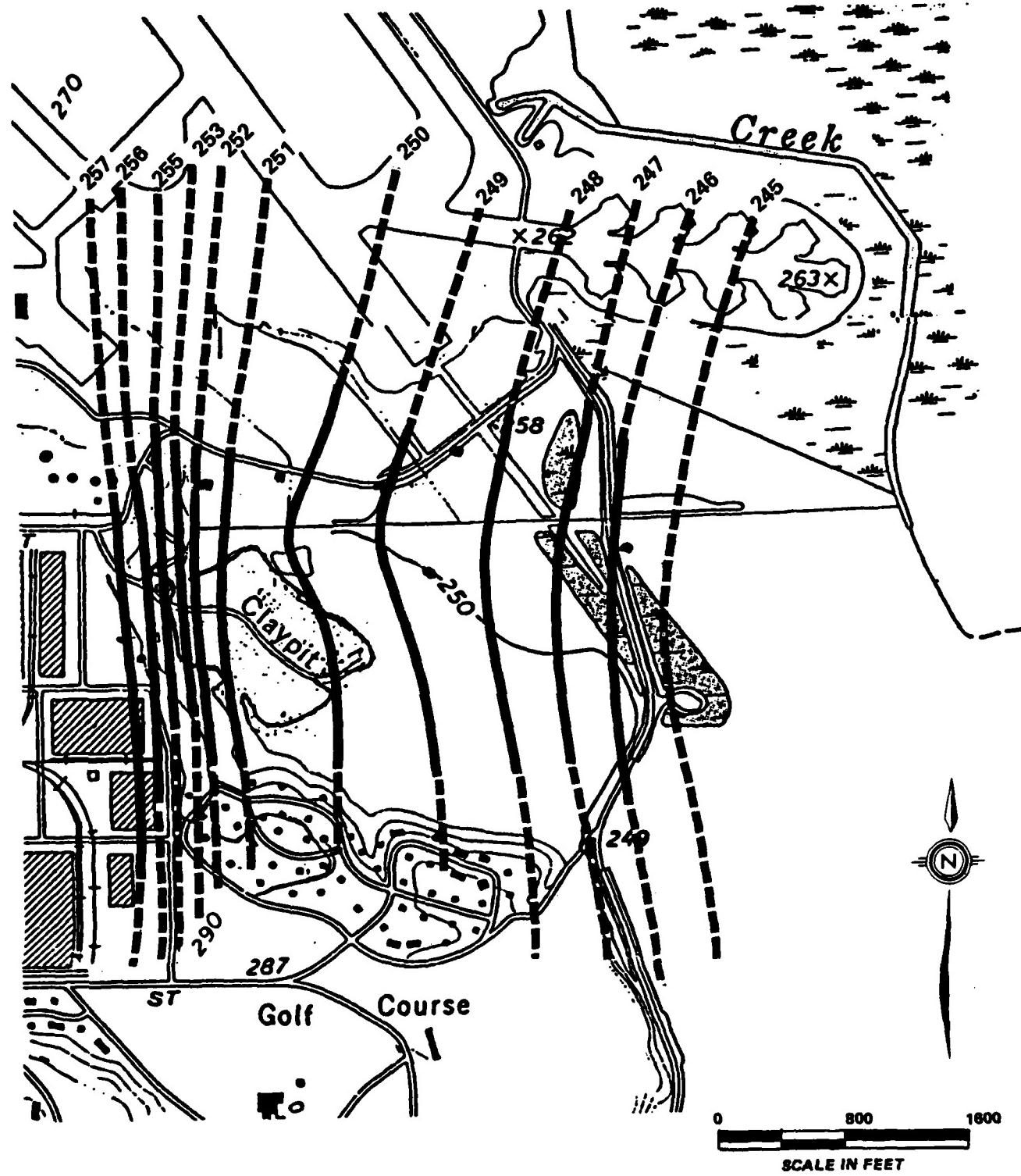
TOC = Top of the protective casing.

msl = Elevation above mean sea level.

DTW = Depth to water.

WL = Water level elevation.





**FIGURE 22. Water Level Elevation Contours (ft. msl) of the Uppermost Aquifer,
Robins Air Force Base, Georgia, March 12, 1984**

East

West

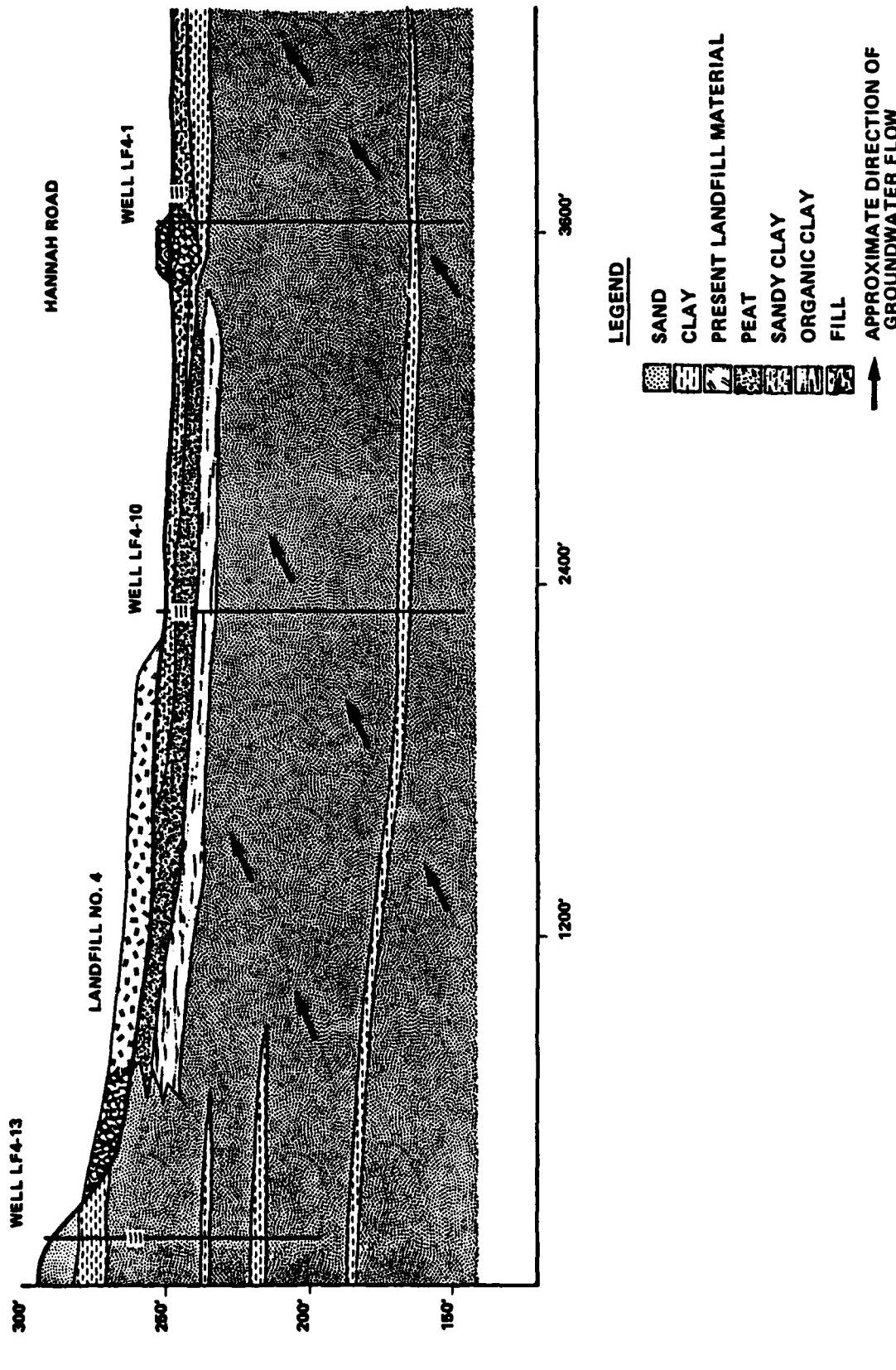


FIGURE 23. Cross Section from Well LF4-13 to Well LF4-1, Robins Air Force Base,
Georgia

Southeast

Northwest

WELL LF1-1
WELL LF1-2
WELL LF1-3

WELL LF4-5

LANDFILL NO. 4

WELL LF4-10

300'

270'

240'

210'

180'

150'

ELEVATION MSL (FEET)

180'

150'

120'

190'

160'

200'

150'

LEGEND

-  SAND
-  CLAY
-  PRESENT LANDFILL MATERIAL
-  PEAT
-  CLAYEY SAND

FIGURE 24. Cross Section from Well LF-1 to Well LF4-10,
Robins Air Force Base, Georgia

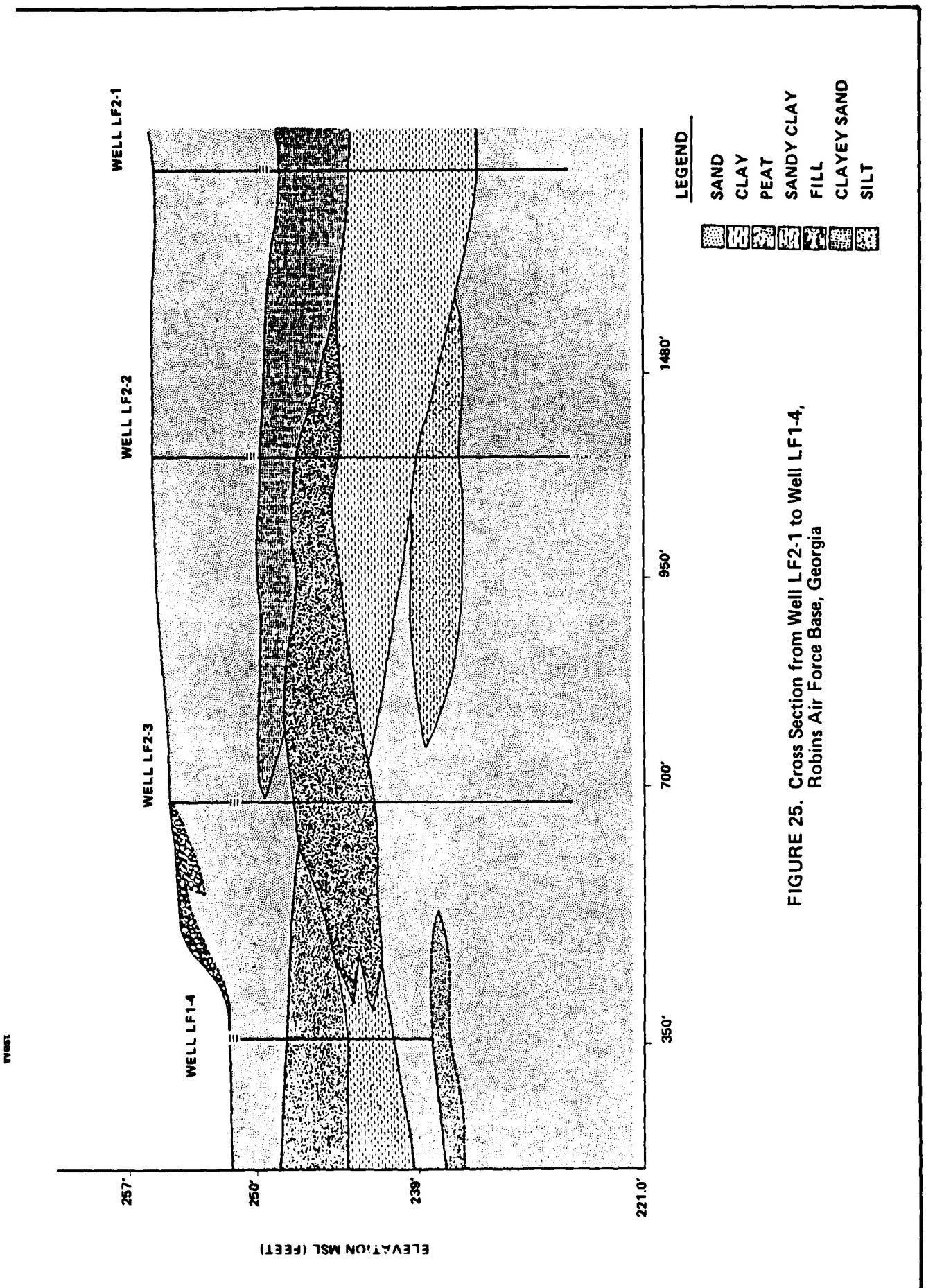


FIGURE 25. Cross Section from Well LF2-1 to Well LF1-4,
Robins Air Force Base, Georgia

LF4-6) exceeded any regulatory standard or criterion (13.4 ug/l human health criterion for ingestion of water and aquatic organisms).

The vertical hydraulic gradient at the Sludge Lagoon is slightly upward, but the apparent contamination of the deeper wells (LF4-3 and LF4-5) by TOX (60 and 220 ug Cl⁻/l) and phenolics (9 and 7 ug/l) indicate downward migration of contaminants from the Sludge Lagoon.

Surface water from station LF4-16 (SW) contained measureable TOX (110 ug Cl⁻/l), DOC, pesticides, phenolics (12 ug/l), copper (6 ug/l), zinc (55 ug/l), and cadmium (7 ug/l). The pesticide scan for this site detected a low concentration of 2,4-D (0.15 ug/l) in March. Sediment samples for station LF4-16 (SED) showed the same pattern as the other sediment samples.

In summary, analyses of samples from Zone 1 confirm contamination of groundwater, surface water, and sediment by organic solvents and cyanide. Nonspecific analyses for specific conductance, phenolics, DOC, and TOX support this conclusion. Groundwater contamination is highest in the vicinity of the Sludge Lagoon. Most significant is the determination that contaminants at the Sludge Lagoon and at the downgradient edge of Landfill No. 4 have migrated deeper into the aquifer against an upward hydraulic gradient. Data for wells on Hannah Road indicate lower levels of contamination on the basis of analyses for TOX and phenolics.

4.2.2 Zone 2, DDT Spill Site

Sample stations for Zone 2 include one monitor well (DDT-1) and four soil sample stations (DDT-S1 through DDT-S4) along the drainage path of the DDT Spill Site (Figure 7).

Although the original scope of work specified analyses for DDT and its breakdown products (DDT-R), apparent chlordane interferences made it desirable to expand the list of analyses to include all organochlorine insecticides.

phenolics [3,300 and 792 micrograms per kilogram (ug/kg)], cyanide, (57,000 and 16,900 ug/kg), nickel (600 and 840 ug/kg), copper (1,090 and 1,590 ug/kg), lead (1,290 and 2,460 ug/kg), zinc (22,400 and 14,100 ug/kg), and chromium (4,340 and 3,720 ug/kg). Cadmium was below the detection limit (50 ug/kg) in both samples. Without long-term, background data from the study area, it is not possible to determine whether these concentrations of metals and phenolics are indicative of natural conditions. However, cyanide is not produced by nature. It is unlikely that any of these constituents would be released from the sediments into the environment in great quantities without drastic changes in pH or Eh.

Analyses of groundwater samples from the Sludge Lagoon confirmed a high level of contamination as indicated by specific conductance, TOX, DOC, purgeable organics, phenolics, and cyanide. In general, the shallow (25 feet) wells (LF4-4 and LF4-6) show a much greater degree of contamination than the associated deeper wells (LF4-3 and LF4-5, respectively) which are 50 feet deep. Of the two shallow wells, LF4-6 taps more highly contaminated groundwater than LF4-4. Specific conductance in wells LF4-4 (131 and 129 umhos/cm in December and March) and LF4-6 (258 and 364 umhos/cm in December and March) is consistently higher than specific conductance in other wells in Zone 1 which was generally less than 50 umhos/cm. TOX in groundwater from the Sludge Lagoon was 60 to 24,000 ug Cl⁻/l. TOX concentrations at the shallow wells (700 and 24,000 ug Cl⁻/l) were the highest measured in this study. DOC was undetectable (<0.3 mg/l) in wells LF4-3 and LF4-5 but was 5.3 and 47.0 mg/l in wells LF4-4 and LF4-6, respectively. A wide variety of purgeable organics at frequently high concentrations (Table 19) were detected in wells LF4-4 and LF4-6 with the latter well being the more contaminated. Trichloroethene was present in the greatest concentration in well LF4-6 (132,000 ug/l). Phenolics concentrations were 67 and 4,640 ug/l in the shallow wells and 9 and 7 ug/l in the deeper wells. Cyanide concentrations in the shallow wells (420 and 1,300 ug/l) exceeded the EPA human health criterion (200 ug/l) for the ingestion of water and aquatic organisms. Of the metals analyses, only nickel (28 ug/l at

Cl^-/l , respectively). Phenolics varied from 4 to 27 $\mu\text{g/l}$ in groundwater. Cyanide concentrations were generally below the detection limit ($<10 \mu\text{g/l}$) in March. However, none of the groundwater samples from Landfill No. 4 proper exceeded the EPA human health criterion for cyanide of 200 $\mu\text{g/l}$ (Table 14). Purgeable organics analyses (Table 19) were performed for wells LF4-7 through LF4-9 which are set in a cluster at depths of 100 feet, 65 feet, and 30 feet, respectively. Concentrations of purgeable organics decreased with depth. Trichloroethene was measured in the highest concentrations and is the best example of this trend. In March, trichloroethene concentrations were 280 $\mu\text{g/l}$ in LF4-9, 40 $\mu\text{g/l}$ in well LF4-8, and $<10 \mu\text{g/l}$ in LF4-7. One or more of these samples exceeded the 10^{-6} incremental cancer risk for human health (Table 14) for carbon tetrachloride, chloroform, trichloroethene, and benzene.

The overall vertical hydraulic gradient for wells LF4-7 through LF4-9 and LF4-10 through LF4-12 was slightly upward (see water level elevations, Table 15). Apparently the weak artesian conditions at wells LF4-7 and LF4-10 and the confining bed (indicated in Figures 23 and 24) were insufficient protection against vertical migration of contaminants.

TOX at surface water stations LF4-14 (SW), LF4-15 (SW), and LF4-17 (SW) was 70, 110, and 190 $\mu\text{g Cl}^-/l$, respectively. Specific conductance was in the range of 158 to 660 umhos/cm at 25°C in December and was measured in the range of 1,520 to 1,920 umhos/cm at 25°C in March. The reason for the difference in these measurements is not apparent. Phenolics (12 to 23 $\mu\text{g/l}$) and DOC (41.2 to 46.6 mg/l) were generally higher than in groundwater, but this is not unusual considering the swampy setting of the samples.

As is usual, concentrations of phenolics, cyanide, and metals were much higher in sediment samples than in the overlying water column. This is due primarily to the high adsorbing capacities of clay minerals (Grim, 1968) and of the organic fraction of soils (Tinsley, 1979). For sediment samples LF4-14 (SED) and LF4-15 (SED) concentrations were as follows:

**Table 20. Pesticide Concentrations in Samples Collected at Landfill 4
and the Sludge Lagoon (Zone 1), Robins AFB, Georgia,
March 1984**

Parameter	SW LF4-16 ug/l	SED LF4-16* ug/kg	LCH Composite ug/l
Aldrin	<0.02	<0.94	<0.02
DDT-R†	<0.02	97.5	<0.02
Dieldrin	<0.02	<0.94	<0.02
Endrin	<0.02	<0.94	<0.02
Heptachlor	<0.02	<0.94	<0.02
Heptachlor epoxide	<0.02	<0.94	<0.02
Lindane	<0.01	<0.47	<0.01
Methoxychlor	<0.2	<9.4	<0.2
Chlordane	<0.02	21.5	0.02
Diazinon	<0.02	<0.075	<0.02
Malathion	<0.1	<0.38	<0.1
Parathion	<0.02	<0.075	<0.02
2,4-D	0.15	1.83	<0.06
2,4,5-T	<0.06	1.45	<0.06
Silvex	<0.02	<0.19	<0.02

*Data given in ug/kg, dry weight.

†Less than values are for each isomer. Detectable quantities are reported as sum of all isomers.

SW = Surface water.

SED = Sediment.

LCH = Leachate.

Table 19. Purgeable Organics Concentrations in Samples Collected in the Vicinity of Landfill 4 and the Sludge Lagoon (Zone 1), Robins AFB, Georgia, March 1984 (Page 2 of 2)

Parameter	LF4-7	LF4-8	LF4-9	LCH Composite	LF4-13
<u>Volatile Halocarbons-All Units ug/l</u>					
Bromodichloromethane	<1	<1	<1	<1	<1
Bromoform	<1	<1	<1	<1	<1
Bromomethane	<1	<1	<1	<1	<1
Carbon tetrachloride	<1	3	32	<1	<1
Chlorobenzene	<1	<1	<1	<1	<1
Chloroethane	<1	<1	<1	<1	<1
2-Chloroethylvinyl ether	<1	<1	<1	<1	<1
Chloroform	<1	<1	3	<1	<1
Chloromethane	<1	<1	<1	<1	<1
Dibromochloromethane	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	<1	<1	<1	<1	<1
1,3-Dichlorobenzene	<1	<1	<1	<1	<1
1,4-Dichlorobenzene	<1	<1	<1	<1	<1
Dichlorodifluoromethane	<1	<1	<1	<1	<1
1,1-Dichloroethane	<1	<1	<1	<1	<1
1,2-Dichloroethane	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloroethene	<1	1	<1	<1	<1
Trans-1,2-Dichloroethene	<1	<1	<1	<1	<1
1,2-Dichloropropane	<1	<1	<1	<1	<1
Cis-1,3-Dichloropropene	<1	<1	<1	<1	<1
Trans-1,3-Dichloropropene	<1	<1	<1	<1	<1
Methylene chloride	<1	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	<1	<1	<1	<1	<1
Tetrachloroethene	<1	<1	4	<1	<1
1,1,1-Trichloroethane	<1	<1	<1	<1	<1
1,1,2-Trichloroethane	<1	<1	<1	<1	<1
Trichloroethene	<10	40	280	<10	<1
Trichlorofluoromethane	<1	<1	<1	<1	<1
Vinyl chloride	2	<1	2	<1	<1
<u>Volatile Aromatics-All Units ug/l</u>					
Benzene	<0.7	<0.7	<0.7	<0.7	<0.7
Ethyl benzene	<1	<1	<1	<1	<1
Toluene	<1	<1	<1	<1	<1

Table 19. Purgeable Organics Concentrations in Samples Collected in the Vicinity of Landfill 4 and the Sludge Lagoon (Zone 1), Robins AFB, Georgia, March 1984 (Page 1 of 2)

Parameter	LF4-4	LF4-6*	SW LF4-16	SED LF4-16†
Volatile Halocarbons-All units ug/l				
Bromodichloromethane	<1	<10	<1	<1
Bromoform	<1	<10	<1	<1
Bromomethane	<1	<100	<1	<1
Carbon tetrachloride	2	<100	<1	<1
Chlorobenzene	<1	120	<1	<1
Chloroethane	<1	<100	<1	<1
2-Chloroethylvinyl ether	<1	<100	<1	<1
Chloroform	<10	<100	<1	5
Chloromethane	<1	<100	<1	<1
Dibromochloromethane	<1	<100	<1	<1
1,2-Dichlorobenzene	<1	505	<1	<1
1,3-Dichlorobenzene	<1	360	<1	<1
1,4-Dichlorobenzene	<1	165	<1	<1
Dichlorodifluoromethane	<1	<100	<1	<1
1,1-Dichloroethane	<100	<100	<1	<1
1,2-Dichloroethane	2	40	<0.1	<1
1,1-Dichloroethene	<2	<10	<1	<1
Trans-1,2-Dichloroethene	125	<10	<1	<1
1,2-Dichloropropane	<1	<10	<1	<1
Cis-1,3-Dichloropropene	<1	<100	<1	<1
Trans-1,3-Dichloropropene	<1	<10	<1	<1
Methylene chloride	2	930	<1	3
1,1,2,2-Tetrachloroethane	<1	<100	<1	<1
Tetrachloroethene	<1	110	<1	<1
1,1,1-Trichloroethane	<1	80	<1	<1
1,1,2-Trichloroethane	<1	<100	<1	<1
Trichloroethene	140	132,000	<10	<1
Trichlorofluoromethane	<1	<10	<1	<1
Vinyl chloride	2,150	110	<1	<1
Volatile Aromatics-All units ug/l				
Benzene	22	505	<0.7	<0.7
Ethyl benzene	<1	86	<1	<1
Toluene	6	455	<1	6

*Data given are average values from two duplicated samples. For data pairs where one value is less than detection limit, one-half of this value is averaged with positive result. See Table H-3.

†These data are given in ug/kg.

SW = Surface water.

SED = Sediment.

LCH = Leachate.

Table 18. Results of Analyses of Environmental Samples Collected in the Vicinity of Landfill 4 and the Sludge Lagoon (Zone 1), Robins AFB, Georgia, March 1984

Station No.	Matrix	pH	Sp. Cond. @ 25°C (umhos/cm)	Cyanide (ug/l)	Purg. Org. (ug/l)	Pesticides (ug/l)
LF4-1	GW	5.0	30	<10	NA	NA
LF4-2	GW	5.1	27	<10	NA	NA
LF4-3	GW	5.6	43	<10	NA	NA
LF4-4	GW	5.4	129	420	*	NA
LF4-5	GW	4.4	27	<10	NA	NA
LF4-6	GW	5.1	364	1,330	*	NA
LF4-7	GW	5.8	31	<10	*	NA
LF4-8	GW	5.8	35	<10	*	NA
LF4-9	GW	5.4	55	<10	*	NA
LF4-10	GW	5.7	30	60	NA	NA
LF4-11	GW	5.1	32	<10	NA	NA
LF4-12	GW	5.2	40	<10	NA	NA
LF4-13	GW	8.4	45	<10	*	NA
LF4-14	SW	6.5	1,920	130	NA	NA
LF4-14	SED	NA	NA	36,000†	NA	NA
LF4-15	SW	6.6	1,590	<10	NA	NA
LF4-15	SED	NA	NA	139,000†	NA	NA
LF4-16	SW	6.4	124	<10	*	**
LF4-16	SED	NA	NA	15,900†	NA	**
LF4-17	SW	6.7	1,580	<10	NA	NA
W-7	GW	4.8	31	<10	NA	NA
W-8	GW	7.0	23	<10	NA	NA
W-15	GW	5.8	35	<10	NA	NA
W-18	GW	4.3	23	<10	NA	NA
LCH Composite (22,23,24)		8.4	54	NA	*	**

*See Table 19.

†These data are given in ug/kg, dry weight.

**See Table 20.

GW = Groundwater.

NA = Not analyzed.

SW = Surface water.

SED = Sediment.

LCH = Leachate.

Table 17. Results of Analyses of Environmental Samples Collected in the Vicinity of Landfill 4 and the Sludge Lagoon
 (Zone 1), Robins AFB, Georgia, December 1983

Station No.	Matrix	pH	Sp. Cond. (@ 25°C)	TOX (urthos/cm) (ug Cl-1)(mg/l)	DOC (ug Cl-1)(mg/l)	Phenolics (ug/l)	Nickel (ug/l)	Copper (ug/l)	Lead (ug/l)	Zinc (ug/l)	Chromium (ug/l)	Cadmium (ug/l)
LF4-1	GW	4.8	18	<10	<0.3	5	20	5	45	24	<10	5
LF4-2	GW	4.6	18	<10	0.3	7	20	5	44	13	<10	5
LF4-3	GW	5.8	42	60	<0.3	9	20	5	30	69	<10	5
LF4-4	GW	5.6	131	700	5.3	67	20	5	30	54	<10	5
LF4-5	GW	5.6	29	220	<0.3	7	20	5	30	42	<10	5
LF4-6	GW	5.4	258	24,000	47.0	4,640	28	5	30	41	<10	5
LF4-7	GW	5.4	35	480	<0.3	1	20	5	30	39	<10	5
LF4-8	GW	5.8	50	170	<0.3	3	20	5	30	405	<10	5
LF4-9	GW	5.3	52	710	<0.3	4	20	5	30	13	<10	5
LF4-10	GW	6.1	29	270	<0.3	5	23	5	30	51	<10	5
LF4-11	GW	5.4	23	560	<0.3	2	20	5	30	24	<10	5
LF4-12	GW	5.4	34	80	<0.3	6	20	5	30	54	<10	5
LF4-13	GW	5.4	27	260	<0.3	<1	27	5	30	66	<10	5
LF4-14	SW	5.7	158	70	41.2	12	20	5	30	10	<10	5
LF4-14	SED	NA	NA	8.5%*	23,700†	4,320†	7,800†	5	30	161,000†	31,200†	<360†
LF4-15	SW	6.6	103	110	44.3	19	<20	5	30	<10	<10	5
LF4-15	SED	NA	NA	NA	8.0%*	4,740†	5,030†	9,520†	14,700†	84,000†	22,300†	<300†
LF4-16	SW	6.0	84	110	17.9	12	20	5	30	55	<10	7
LF4-16	SED	NA	NA	NA	6.2%*	1,770†	11,600†	33,900†	261,000†	114,000†	248,000†	17,800†
LF4-17	SW	6.4	660	190	46.6	23	20	5	30	<10	<10	5
W-7	GW	4.3	22	20	<0.3	8	20	5	30	42	<10	5
W-8	GW	4.2	14	10	<0.3	15	20	5	30	64	<10	5
W-15	GW	4.8	21	<10	<0.3	11	20	5	30	64	<10	5
W-18	GW	4.4	13	430	<0.3	29	20	5	30	21	<10	5
LCH Composite (LF4-22,23,24)		5.2	28	NA	NA	NA	NA	NA	NA	NA	NA	NA

*Loss on ignition 103°C to 550°C.

†These data are given in ug/kg, dry weight.

GW = Groundwater.

NA = Not analyzed.

SW = Surface water.

SED = Sediment.

LCH = Leachate.

Table 16. Monitor Wells Associated with Zone 1 (Landfill 4 and Sludge Lagoon) Installed During the Phase II, Stage 1 Study

	Finished Well Depth (ft)	Vertical Hydraulic Gradient Direction
1 Cluster of 2 on Hannah Road		
LF4-1	100	Upward
LF4-2	50	
2 Clusters of 2 at Sludge Lagoon		
LF4-3	50	Upward
LF4-4 and	25	
LF4-5	50	Upward
LF4-6	25	
2 Clusters of 3 off Toe of Landfill 4		
LF4-7	100	Upward
LF4-8	65	
LF4-9 and	30	
LF4-10	100	Overall gradient (LF4-10 to LF4-12) is upward, but gradient between LF4-12 and LF4-11 is downward
LF4-11	65	
LF4-12	30	
Single Upgradient		
LF4-13	100	

the soil. DOC data for this survey are evaluated subjectively as an indication of general organic contamination.

4.2.1 Zone 1, Landfill No. 4 and Sludge Lagoon

Sampling stations for Zone 1 include 17 monitor wells, four surface water stations, three sediment stations, and three leachate stations (Figure 5). They fall into four groups: the upgradient well (LF4-13), Hannah Road wells, Landfill No. 4 proper, and the Sludge Lagoon. Since wells monitoring Zone 1 include five clusters sampling separate vertical zones, Table 16 is included to clarify the depth relationships of wells within a cluster. Analytical data are in Tables 17 through 20.

Water quality in the upgradient well indicated apparent contamination by TOX (260 ug Cl⁻/l). Nickel (27 ug/l) was above the EPA human health criterion of 13.4 ug/l (Table 14).

Samples from the Hannah Road wells (LF4-1, LF4-2, W-15, and W-18) detected possible contamination from phenolics (5 to 29 ug/l). TOX was below the detection limit in all wells except W-18 (430 ug Cl⁻/l). Specific conductance was low in December (13 to 21 umhos/cm at 25°C) and March (23 to 35 umhos/cm at 25°C). The vertical hydraulic gradient between wells LF4-1 (100 feet deep) and LF4-2 (50 feet deep) was upward in December and March.

Samples from stations at Landfill No. 4 included eight monitor wells (LF4-7 through LF4-12, W-7, and W-8), three surface water stations [LF4-14 (SW), LF4-15 (SW), and LF4-17 (SW)], two sediment sample stations [LF4-14 (SED) and LF4-15 (SED)], and leachate composited from three stations [LF4-22 (LCH) through LF4-24 (LCH)].

The EPA groundwater contamination indicators (GWCIs) (pH, specific conductance, DOC, and TOX) at Landfill No. 4 were unremarkable except for TOX which varied from 80 to 710 ug Cl⁻/l in wells LF4-7 through LF4-12; TOX values in samples from wells W-7 and W-8 were low (20 and 10 ug

volatile halocarbon tests. However, there are many organohalides that would not be detected by these procedures. TOX data are best used as an indicator of whether the compound-specific analyses (e.g., dichloroethylene, DDT, etc.) account for all of the organohalides in the sample.

There are no criteria or standards for direct evaluation of TOX data. If used in a rigorous manner (e.g., RCRA compliance monitoring), extensive background and monitoring data bases are required to determine statistically whether monitoring well levels are significantly higher than background well levels. When used as a screening indicator, as is the case with the Robins AFB Phase II, Stage 1 survey, such data are not available. For the purposes of interpreting TOX data reported in this survey, a TOX concentration of 40 ug Cl⁻/l was selected as being sufficiently high to indicate the potential for significant groundwater contamination. This concentration is based on the EPA mcl for trihalomethanes (THMs) which is 100 micrograms per liter (ug/l) for the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane concentrations. Molecular weights for these species range from 119.4 for chloroform to 252.8 for bromoform. A chloroform concentration of 100 ug/l would be equivalent to 89 ug Cl⁻/l reported as TOX, the ratio of the chloride weight ($3 \times 35.5 = 106.5$) to the molecular weight (119.4). A bromoform concentration of 100 ug/l would be equivalent to 42 ug Cl⁻/l reported as TOX, the ratio of the halogen weight reported as chlorine ($3 \times 35.5 = 106.5$) to the molecular weight (252.8). The cut-off level for TOX, 40 ug Cl⁻/l, was based on the concentration of bromoform that could be present in a sample without exceeding the 100 ug/l THM standard. A TOX concentration of 40 ug Cl⁻/l corresponds to a range of 45 ug/l (all chloroform) to 95 ug/l (all bromoform) total THMs. These comparisons are based on molecular weight considerations only and assume 100 percent accuracy of the analytical method.

Similarly, there are no criteria or standards for direct evaluation of DOC data. Background DOC concentrations in natural water samples can vary widely, depending primarily on decomposition of organic matter in

Specific conductance and pH of natural groundwater vary widely and should be assessed in terms of long-term data or local context. LeGrand (1962) reported that total dissolved solids (TDS) in groundwater in the Macon area varied from 19 mg/l to 135 mg/l with most of the values being less than 50 mg/l. These values of TDS are approximately equivalent to specific conductance values of 20 umhos/cm to 250 umhos/cm. LeGrand also reported values of pH varying from 3.7 to 7.5; the low end of the range indicates that natural groundwater may be more acidic than the EPA National Interim Drinking Water Standard of 6.5 to 8.5 (Table 13).

The test for phenolics used during this study is also a screening test which does not differentiate between synthetic phenolic compounds and naturally occurring phenolic compounds which result from decaying organic matter. The screening test for phenolics will not detect 2,4-dinitrophenol, 2-methyl-4,6-dinitrophenol, or 4-nitrophenol. It may or may not detect 2,4-dimethylphenol.

Although there is no drinking water standard for phenolics, EPA has established water quality criteria for 21 specific phenolic compounds, as listed in Table 14. These criteria can be used for comparison with total phenolic data only to determine whether the potential exists for criteria to be exceeded. If the total phenolic concentration of a water sample exceeds a criterion for a specific phenolic compound or group of phenolic compounds, then the potential exists for that criterion to be exceeded. The lowest ambient criterion for a specific phenolic compound is 0 ug/l (for 2,4,6-trichlorophenol); therefore, any detectable phenolics may exceed an established criterion.

TOX is a measure of organohalides which are organic compounds containing one or more halogens (fluorine, chlorine, bromine, iodine, and astatine). The organohalides constitute a very large class of organic compounds with widespread use in modern society. There were additional tests used at Robins AFB that measured some, but not all, specific organohalide compounds, namely the organochlorine insecticide, herbicide, PCB, and

which indicate whether the vertical movement of groundwater is upward (discharge) or downward (recharge).

Results of the chemical analyses are discussed on a zone-by-zone basis in the following sections. QA/QC program results are discussed in Appendix H.

Data for cyanide, purgeable organics, and pesticides were obtained in both December 1983 and March 1984. The samples obtained in December 1983 were analyzed after exceeding either the holding times or extraction times specified in the analytical method. This would generally result in a loss of the constituents of interest and hence yield data which could underestimate the levels of contamination. In accordance with an OEHL decision that in all Phase II studies, data from analyses which exceed holding or extraction times will not be used to confirm or deny contamination at IRP study sites (OEHL, 1985; Wooten, 1985), these data have been relegated to Appendix L.

The March 1984 data was analyzed in accordance with the specifications of the methods and the data for pesticides and purgeable organics were verified by a second gas chromatographic (GC) column for any analyte which exceeded the threshold for confirmation specified by OEHL (Baladi, 1984).

In assessing the analytical results of this study, it is important to recognize that some of the analytical parameters are general indicators of water quality (pH and specific conductance), and others measure entire classes of chemical substances without differentiating among members of the class (TOX, DOC, and phenolics). Although it is desirable to compare results of analyses of environmental samples to regulatory standards and criteria, there are no standards or criteria for most of the general indicators (except pH) or for many specific parameters.

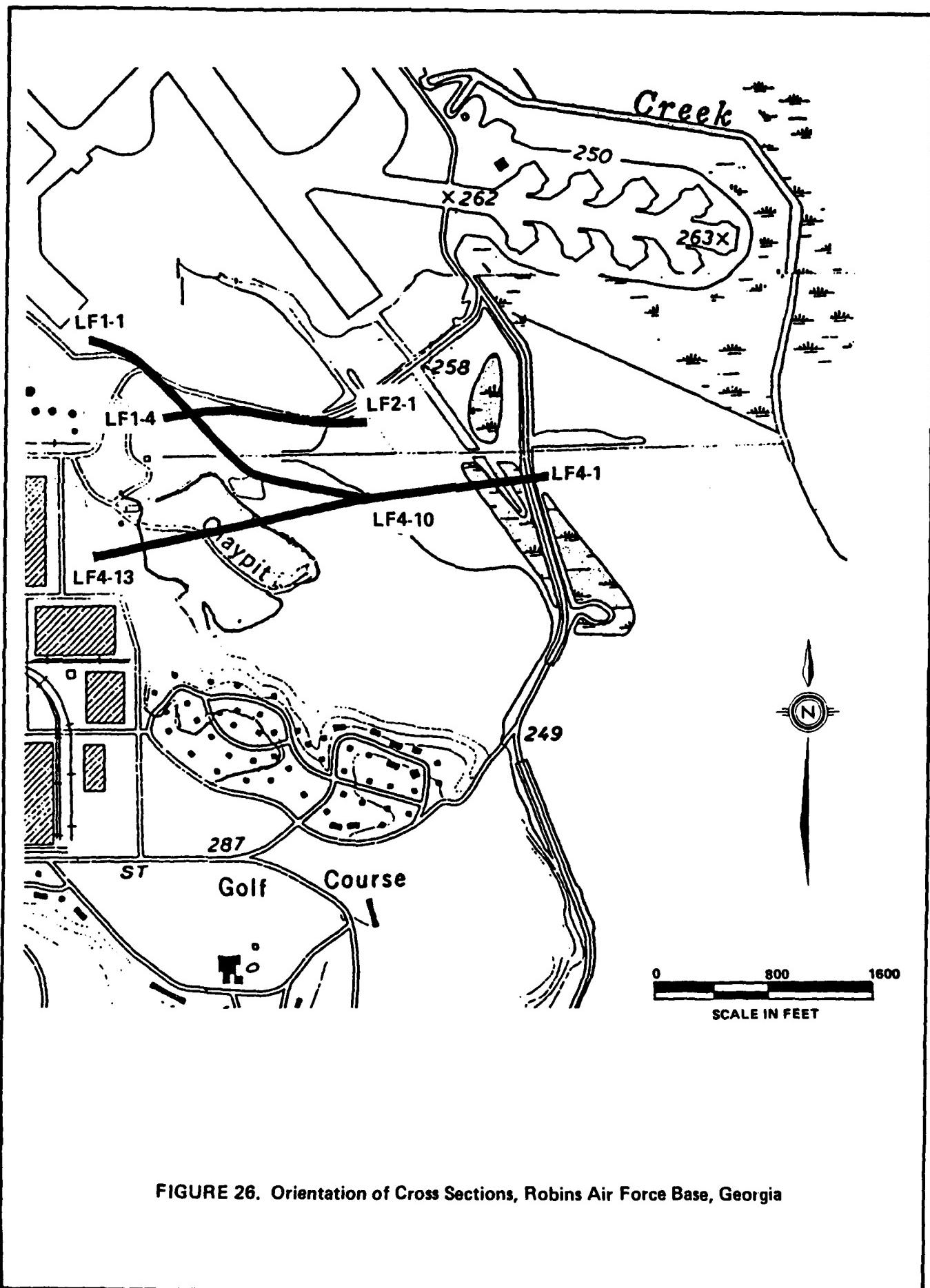


FIGURE 26. Orientation of Cross Sections, Robins Air Force Base, Georgia

In the groundwater samples from monitor well DDT-1 (45 feet deep), DDT was below the detection limit (0.02 ug/l) however, insecticides were detected. In March (Table 21), the only detectable organochlorine insecticide was chlordane (0.04 ug/l) which exceeded the EPA human health criterion for ingestion of water (0 ug/l).

In March, the chlordane values varied from 870 ug/kg to 251,000 ug/kg while DDT-R varied from 400 ug/kg to 227,000 ug/kg. For comparison, these concentrations of DDT-R are on the same order of magnitude as soil concentrations of DDT-R (600 to 750,000 ug/kg) measured in a drainage ditch which received process wastes from a DDT manufacturing plant in Alabama (WAR, 1980). In both sampling periods, the lowest concentrations were obtained at station DDT-S1 which is closest to the spill site. No other pesticides were detected in the soil samples, but this may be a result of analytical interferences caused by the high concentrations of chlordane and DDT-R in the soil samples.

In summary, groundwater and soils samples from the DDT Spill Site were contaminated by pesticides. Groundwater in the perched water table beneath the site was contaminated by low concentrations of pesticides; however, it is probable that these pesticides would be attenuated by soils materials before reaching the closest downgradient water supply well (WS-5) which is approximately 0.5 miles east of the site. Soils in the drainage ditch near the site contained concentrations of DDT and chlordane that varied from several hundred parts per billion to several hundred parts per million. This drainage ditch leads to a drainage way which flows into Duck Lake. Duck Lake is stocked with catfish for recreational fishing and may contain other edible fish species. Contaminated soil could be transported via the drainage way to Duck Lake.

4.2.3 Zone 3, Fire Protection Training Area No. 2

Sample stations at Zone 3 (Figure 8) consisted of three wells which are completed in two, possibly three, separate aquifers. Well FPT2-1

Table 21. Results of Analyses of Environmental Samples Collected in the Vicinity of the DDT Spill Site (Zone 2), Robins AFB, Georgia, March 1984

Parameter	DDT-1	DDT-S1*	DDT-S2*	DDT-S3*	DDT-S4*
Matrix	GW	Soil	Soil	Soil	Soil
pH	4.7	NA	NA	NA	NA
Sp. Cond. @ 25°C (umhos/cm)	90	NA	NA	NA	NA
Aldrin	<0.02	<5.0	<70	<2,500	<250
Dieldrin	<0.02	<5.0	<70	<2,500	<250
Endrin	<0.02	<5.0	<70	<2,500	<250
Heptachlor	<0.02	<5.0	<70	<2,500	<250
Heptachlor epoxide	<0.02	<5.0	<70	<2,500	<250
Lindane	<0.01	<2.5	<35	<1,250	<250
Methoxychlor	<0.2	<50	<700	<2,500	<125
Chlordane	0.04	871	14,800	251,000	41,600
DDT-R†	<0.02	400	1,280	227,000	22,700

*These data are given in ug/kg, dry weight. All other units for pesticides are ug/l.

†Less than values are for each isomer. Detectable quantities are reported as sum of all isomers.

GW = Groundwater.

NA = Not analyzed.

(20 feet deep) monitors the water-table aquifer which is underlain by more than 30 feet of dense, unweathered clay. Well FPT2-2 (84 feet deep) monitors the confined aquifer immediately beneath the clay zone. Since the Providence Sand and Tuscaloosa Formation consist of sand with interbedded clay lenses (Table 5), it is possible that well WS-12 may tap a third aquifer zone, but there is no well log to confirm this. Water supply well WS-12 is used to maintain water levels at Luna Lake. Water supply well WS-11 was not sampled due to an obstruction in the well.

As discussed in Section 3.2, the water-table aquifer exhibited obvious signs of contamination (oil and fuel or solvent odors) during monitor well construction (see well logs, pages F-3 and F-4). This evidence is reinforced by the analytical results (Tables 22 and 23) for specific conductance (1,050 umhos/cm and 1,150 umhos/cm), TOX (100 ug Cl⁻/l), DOC (93.5 mg/l), lead (109 ug/l), and purgeable organics for well FPT2-1. A wide variety of purgeable organic compounds were present in high concentrations in March (Table 23). Several solvents greatly exceeded EPA water quality criteria for ingestion of water (Table 14). These included benzene (125 ug/l versus a criterion of 0 ug/l), ethyl benzene (105 ug/l versus a criterion of 1.4 ug/l), toluene (440 ug/l versus a criterion of 14.3 ug/l), and chloroform (1,150 ug/l versus a criterion of 0 ug/l). The concentration of lead in well FPT2-1 (109 ug/l) is more than twice the EPA interim primary drinking water standard of 50 ug/l.

TOX concentrations in samples from wells FPT2-2 (70 ug Cl⁻/l) and WS-12 (300 ug Cl⁻/l) are indicative of contamination by halogenated organic compounds, but if TOX is a reliable indication, the contamination is due to compounds other than volatile halocarbons (VOH) (Table 26). No purgeable organics were detected in groundwater from well FPT2-2 in March. There were no purgeable organics detected in WS-12 in March. This latter well also had low levels of phenolics (10 ug/l); all of which exceed or may exceed regulatory standards (Table 14).

Table 22. Results of Analyses of Environmental Samples Collected
in the Vicinity of the Fire Protection Training Area No. 2
(Zone 3), Robins AFB, Georgia, December 1983

Station No.	Matrix	pH	Sp. Cond. @ 25°C (umhos/cm)	TOX (ug Cl ⁻ /l)	DOC (mg/l)	Phenolics (ug/l)	Lead (ug/l)
FPT2-1*	GW	7.2	1,050	100	93.5	NA	109
FPT2-2†	GW	9.8	66	70	1.6	NA	<30
WS-12†	GW	3.6	34	300	<0.3	10	<30

*1.3 feet of oil on top of water surface.

†Wells FPT2-2 and WS-12 are completed in confined aquifers.
Unable to sample WS-11.

GW = Groundwater.

NA = Not analyzed.

Table 23. Results of Analyses of Environmental Samples Collected in the Vicinity of the Fire Protection Training Area No. 2 (Zone 3), Robins AFB, Georgia, March 1984

Parameter	FPT 2-1	FPT 2-2	WS-12
pH	5.8	5.7	4.1
Sp. Cond. @ 25°C (umhos/cm)	1,150	93	48
Cyanide (ug/l)	NA	NA	<10
<u>Volatile Halocarbons-All Units ug/l</u>			
Bromodichloromethane	<10	<1	<1
Bromoform	<1	<1	<1
Bromomethane	<1	<1	<1
Carbon tetrachloride	<10	<1	<1
Chlorobenzene	3,570	<1	<1
Chloroethane	20	<1	<1
2-Chloroethylvinyl ether	3	<1	<1
Chloroform	1,150	<1	<1
Chloromethane	<1	<1	<1
Dibromochloromethane	<100	<1	<1
1,2-Dichlorobenzene	<100	<1	<1
1,3-Dichlorobenzene	<100	<1	<1
1,4-Dichlorobenzene	<100	<1	<1
Dichlorodifluoromethane	<1	<1	<1
1,1-Dichloroethane	<1	<1	<1
1,2-Dichloroethane	<10	<1	<1
1,1-Dichloroethene	1	<1	<1
Trans-1,2-Dichloroethene	<10	<1	<1
1,2-Dichloropropane	1	<1	<1
Cis-1,3-Dichloropropene	<100	<1	<1
Trans-1,3-Dichloropropene	<1	<1	<1
Methylene chloride	560	<1	<1
1,1,2,2-Tetrachloroethane	<100	<1	<1
Tetrachloroethene	<100	<1	<1
1,1,1-Trichloroethane	<1	<1	<1
1,1,2-Trichloroethane	<100	<1	<1
Trichloroethene	<100	<1	<1
Trichlorofluoromethane	8	<1	<1
Vinyl chloride	36	<1	<1
<u>Volatile Aromatics-All Units ug/l</u>			
Benzene	125	<0.7	<0.7
Ethyl benzene	105	<1	<1
Toluene	435	<1	<1

NA = Not analyzed.

Hydrologic conditions at Zone 3 favor migration of water from the water-table aquifer to the next lower aquifer. Walton (1970) states that vertical leakage through a confining bed may be estimated from a modified form of the Darcy equation:

$$Q = (K' \Delta h A_c) / m'$$

where K' = vertical hydraulic conductivity of the confining bed,

Q = vertical leakage,

m' = thickness of the confining bed,

A_c = area over which leakage occurs, and

Δh = head difference between the two aquifers.

The approximate leakage per square foot ($A_c = 1 \text{ ft}^2$) at Zone 3 may be calculated by assuming K' of the unweathered clay confining bed is $1 \times 10^{-4} \text{ gpd/ft}^2$ (Freeze and Cherry, 1979) and using values of m' (37 ft) and Δh (22.78 ft) determined in this study. These values yield an approximate leakage of $6 \times 10^{-5} \text{ gpd/ft}^2$ (0.02 gallons per year per square foot) which is an extremely low rate of leakage.

The rate of flow could be greater if the synthetic organic solvents produced higher hydraulic conductivities as reported by Brown (1982); however, water quality in well FPT2-2 does not indicate solvent contamination of the next lower aquifer.

It is worth noting that TOX values for wells FPT2-1, FPT2-2, and WS-12 do not correlate with total VOH. In the well FPT2-1, TOX was far lower than would be expected from the total VOH. The reverse is true for wells FPT2-2 and WS-12 where TOX is greater than would be expected on the basis of total VOH. Although the latter trend is inconclusive on the basis of present data, it is interesting when taken in the context of the study site.

In summary, the water-table aquifer at Fire Protection Training Area No. 2 is highly contaminated with petroleum products, organic solvents, and lead being the primary contaminants; an oil layer (1.3 feet) was

present on the water surface in the shallow well before the December sampling. Despite a downward vertical hydraulic gradient, groundwater from the next lower (confined) aquifer showed no sign of contamination from oil, solvents, or lead, but it did have a TOX concentration of 70 ug Cl⁻/l. The water supply well (WS-12) at the site showed possible contamination by TOX and phenolics in December.

4.2.4 Zone 4, Landfill No. 1 and JP-4 Spill Site

Sample stations for Zone 4 consisted of five shallow monitor wells (wells LF1-1 through LF1-5) (Figure 9). Results of analyses for samples collected within Zone 4 are summarized in Tables 24 and 25.

GWCI parameters indicate contamination in all Zone 4 wells, primarily by organic halogens. TOX concentrations range from 90 to 220 ug Cl⁻/l in samples from the five wells. With the exception of high specific conductance (727 umhos/cm) and moderately elevated DOC (37.3 mg/l) in well LF1-4, all other GWCI parameters within this zone are within the range of expected natural background conditions.

Analyses for purgeable organics were performed only on samples from wells LF1-2 and LF1-3. Groundwater from well LF1-2 contained 2 ug/l of trichloroethene in March 1984. This concentration exceeds the ambient criterion of 0 ug/l (Table 14).

Total detectable purgeable organics in well LF1-3 was a mean of 950 ug/l for the March 1984 duplicate sample. Six constituents account for the total concentrations reported: 1,2-dichlorobenzene; 1,3-dichlorobenzene; 1,4-dichlorobenzene; trichloroethene; ethyl benzene; and toluene. All other constituents were not detected.

Table 24. Results of Analyses of Environmental Samples Collected in the Vicinity of Landfill 1 (Zone 4), Robins AFB, Georgia,
December 1983

Station No.	Matrix	pH	(µhos/cm)	TOX (µg Cl ⁻ /1)(mg/l)	DOC (µg Cl ⁻ /1)(mg/l)	Phenolics (µg/l)	O&G (mg/l)	Depth of Fuel Layer (feet)				
								Sp. Cond. (@25°C)	Copper (µg/l)	Nickel (µg/l)	Lead (µg/l)	Zinc (µg/l)
LFI-1	GW	5.5	114	90	2.2	61	0.8	0	<20	5	<30	244
LFI-2	GW	5.4	68	110	1.1	12	0.3	0	<20	9	<30	456
LFI-3	GW	5.3	107	100	10.8	201	12.0	2.3	<20	5	<30	45
LFI-4	GW	6.0	727	100	37.3	14	1.7	0	<20	5	<30	44
LFI-5	GW	5.4	97	220	<0.3	19	1.0	0	<20	5	<30	110

GW = Groundwater.

NA = Not analyzed.

Table 25. Results of Analyses of Environmental Samples Collected in the Vicinity of Landfill 1 (Zone 4), Robins AFB, Georgia, March 1984

Parameter	LF1-1	LF1-2	LF1-3	LF1-4	LF1-5
pH	5.2	5.5	5.5	6.2	5.9
Sp. Cond. @ 25°C (umhos/cm)	101	89	91	1,418	125
Cyanide (ug/l)	275	15	165	235	<10
<u>Volatile Halocarbons-All units ug/l</u>					
Bromodichloromethane	NA	<1	<1	NA	NA
Bromoform	NA	<1	<1	NA	NA
Bromomethane	NA	<1	<1	NA	NA
Carbon tetrachloride	NA	<1	<1	NA	NA
Chlorobenzene	NA	<1	<1	NA	NA
Chloroethane	NA	<1	<1	NA	NA
2-Chloroethylvinyl ether	NA	<1	<1	NA	NA
Chloroform	NA	<1	<1	NA	NA
Chloromethane	NA	<1	<1	NA	NA
Dibromochloromethane	NA	<1	<1	NA	NA
1,2-Dichlorobenzene	NA	<1	86	NA	NA
1,3-Dichlorobenzene	NA	<1	7	NA	NA
1,4-Dichlorobenzene	NA	<1	40	NA	NA
Dichlorodifluoromethane	NA	<1	<1	NA	NA
1,1-Dichloroethane	NA	<1	<1	NA	NA
1,2-Dichloroethane	NA	<0.1	<1	NA	NA
1,1-Dichloroethene	NA	<1	<1	NA	NA
Trans-1,2-Dichloroethene	NA	<1	<10	NA	NA
1,2-Dichloropropane	NA	<1	<1	NA	NA
Cis-1,3-Dichloropropene	NA	<1	<1	NA	NA
Trans-1,3-Dichloropropene	NA	<1	<1	NA	NA
Methylene chloride	NA	<1	<1	NA	NA
1,1,2,2-Tetrachloroethane	NA	<1	<1	NA	NA
Tetrachloroethene	NA	<1	<1	NA	NA
1,1,1-Trichloroethane	NA	<1	<1	NA	NA
1,1,2-Trichloroethane	NA	<1	<1	NA	NA
Trichloroethene	NA	2	210	NA	NA
Trichlorofluoromethane	NA	<1	<1	NA	NA
Vinyl chloride	NA	<1	<1	NA	NA
<u>Volatile Aromatics-All units ug/l</u>					
Benzene	NA	<0.7	<10	NA	NA
Ethyl benzene	NA	<1	28	NA	NA
Toluene	NA	<1	580	NA	NA

NA = Not analyzed.

The March samples from well LF1-3 contained 580 ug/l of toluene which is well above the EPA ambient criterion of 14.3 ug/l for human health.

Concentrations of total phenolics in the five Zone 4 wells ranged from 12 to 201 ug/l. These concentrations exceed EPA ambient criteria for specific phenolic compounds (2,4-dichlorophenol; 2,4-dinitro-o-cresol; dinitrophenol; and phenol) given in Table 14.

Oil and grease was detected at low levels in all Zone 4 wells with the exception of well LF1-3. An oil and grease concentration of 12 mg/l is reported for well LF1-3, which prior to initial sampling contained approximately 2.3 feet of fuel (Table 24). Given the quantity of fuel measured in well LF1-3, it may seem that the oil and grease results should be higher than 12 mg/l; however, the presampling purge would remove all of the fuel and water standing in the well. Since fuel flows through soil at a rate approximately half that of groundwater, the well would be recharged much more quickly with water than fuel. Consequently, a sample collected immediately following the purge would contain less fuel than one might expect.

Cyanide concentrations for the March 1984 samples from wells LF1-1, LF1-3, and LF1-4 range from 165 to 275 ug/l and exceed EPA ambient criterion (200 ug/l) and/or the EPA maximum concentration for protection of freshwater aquatic life (52 ug/l). It should be recognized that the presence of fuel in well LF1-3 may have caused interferences in the cyanide analyses for this well since fatty acids or oil could co-distill with cyanide and contribute to the turbidity of the sample. This would not be the case for other wells at Zone 4 since they did not contain free-floating fuel.

Metals analyses for Zone 4 water samples indicate no significant contamination for the six metals reported. Lead, chromium, and cadmium were below detection limits (30, 10, and 5 ug/l, respectively) in all samples. Detection limits for these metals are below primary mcls for drinking

water (see Table 13). Copper was detected in well LF1-2 at a concentration of 9 ug/l, well below the secondary mcl of 1,000 ug/l. Zinc concentrations in the five wells ranged from 44 to 456 ug/l, well below the secondary mcl of 5,000 ug/l. Nickel was not detected in any of the five samples. The detection limit reported for nickel is 20 ug/l.

In summary, contamination of shallow groundwater within Zone 4 is indicated by the presence of TOX, phenolics, and cyanides in nearly all monitoring wells. Samples from well LF1-3 had high concentrations of purgeable organics and oil and grease. An estimated 2.3 feet of fuel was present in well LF1-3 prior to initial sampling. Cyanide concentrations in the March 1984 samples from wells LF1-1 and LF1-4 exceed the EPA ambient criterion of 200 ug/l. Results of metals analyses indicated no significant contamination due to cadmium, chromium, copper, lead, nickel, or zinc.

4.2.5 Zone 5, Landfill No. 2 and Fire Training Area No. 1

Sampling stations for Zone 5 included three shallow monitor wells (LF2-1, LF2-2, and LF2-3) and three surface water sampling stations (LF2-4, LF2-5, and LF2-6) as shown on Figure 9. Results of analyses for samples collected within Zone 5 are summarized in Tables 26 and 27.

Of the GWCI parameters, only TOX indicates significant contamination in Zone 5 samples. TOX concentrations range from 110 to 490 ug Cl⁻/l. Specific conductance, pH, and DOC values for Zone 5 are within the range of expected natural background conditions.

Concentrations of total detectable purgeable organics in Zone 5 water samples range from 100 to 830 ug/l in groundwater samples and below detection limits to 5,340 ug/l in surface water samples. Purgeable organics were not detected in significant quantities in samples from surface water station LF2-5. In the remaining five stations, 96 to over 99 percent of the total detectable purgeable organic concentration consists of the following constituents: chlorobenzene, dichlorobenzenes,

**Table 26. Results of Analyses of Environmental Samples Collected in the Vicinity of Landfill 2 (Zone 5),
Robins AFB, Georgia, December 1983**

Station No.	Matrix	Sp. Cond. @ 25°C	TOX (ug Cl ⁻ /1)	DOC (mg/1)	Phenolics (ug/1)	Nickel (ug/1)	Copper (ug/1)	Lead (ug/1)	Zinc (ug/1)	Chromium (ug/1)	Cadmium (ug/1)
LF2-1	GW	5.6	289	180	1.3	10	<20	5	<30	46	<10
LF2-2	GW	5.0	58	240	<0.3	2	<20	5	31	<10	<10
LF2-3	GW	5.2	78	330	<0.3	2	<20	5	<30	58	<10
LF2-4	SW	6.1	59	490	<0.3	3	<20	5	<30	43	27
LF2-5	SW	6.8	367	110	9.6	4	<20	5	<30	<10	<5
LF2-6	SW	6.3	130	190	3.0	10	<20	65	32	77	<10

GW = Groundwater.

SW = Surface water.

Table 27. Results of Analyses of Environmental Samples Collected in the Vicinity of Landfill 2 (Zone 5), Robins AFB, Georgia, March 1984

Parameter	LF2-1	LF2-2	LF2-3	SW LF2-4	SW LF2-5	SW LF2-6
pH	5.8	5.2	6.2	6.1	7.2	6.5
Sp. Cond. @ 25°C (umhos/cm)	632	118	132	113	837	156
Cyanide (ug/l)	<10	<10	<10	<10	<10	<10
Volatile Halocarbons-All units ug/l						
Bromodichloromethane	<1	<1	<1	<1	<1	1
Bromoform	<1	<1	<1	1	<1	<1
Bromomethane	<1	<1	<1	<1	<1	<1
Carbon tetrachloride	<1	<1	<1	<1	<1	<1
Chlorobenzene	15	<1	<1	2	<1	20
Chloroethane	<1	<1	<1	<1	<1	<1
2-Chloroethylvinyl ether	<1	<1	<1	<1	<1	<1
Chloroform	<1	<1	<1	<1	<1	2
Chloromethane	<1	<1	<1	<1	<1	<1
Dibromochloromethane	<1	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	77	2	2	180	<1	<2
1,3-Dichlorobenzene	7	2	2	7	<1	<2
1,4-Dichlorobenzene	32	<1	<1	<1	<1	<2
Dichlorodifluoromethane	<1	<1	<1	<1	<1	<1
1,1-Dichloroethane	<1	<1	<1	<1	<0.1	<1
1,2-Dichloroethane	3	3	<1	16	<1	2
1,1-Dichloroethene	<1	<1	1	3	<1	<1
Trans-1,2-Dichloroethene	<10	<10	<10	<10	<1	<10
1,2-Dichloropropane	<1	<1	<1	<1	<1	<1
Cis-1,3-Dichloropropene	<1	<1	<1	<1	<1	<1
Trans-1,3-Dichloropropene	<1	<1	<1	<1	<1	<1
Methylene chloride	<1	<1	<1	<1	<1	20
1,1,2,2-Tetrachloroethane	<1	<1	<1	<1	<1	<1
Tetrachloroethene	<1	<1	<1	<1	<1	30
1,1,1-Trichloroethane	<1	<1	<1	<1	<1	<1
1,1,2-Trichloroethane	<1	<1	<1	<1	<1	2
Trichloroethene	19	66	52	5,080	<1	495
Trichlorofluoromethane	<1	<1	<1	<1	<1	<1
Vinyl chloride	79	210	760	4	<1	19
Volatile Aromatics-All units ug/l						
Benzene	18	<1	<1	<1	<0.7	<10
Ethyl benzene	<1	<1	8	<1	<1	<1
Toluene	8	2	4	36	<1	<1

SW = Surface water.

tetrachloroethene, trichloroethene, vinyl chloride, benzene, ethyl benzene, and toluene.

Tetrachloroethene was detected in water from LF2-6 (SW) at a level of 30 ug/l, below the EPA criterion for chronic toxicity to aquatic life (840 ug/l). Trichloroethene was detected (30 ug/l) in the March sample from LF 2-6; this concentration is below the EPA criterion for chronic toxicity to freshwater aquatic life (21,900 ug/l) but well above the criterion for an incremental cancer risk over a lifetime of 10^{-6} (2.7 ug/l). Vinyl chloride was detected in five of six March 1984 samples at concentrations of 4 to 760 ug/l. These concentrations are 2 to 380 times the EPA criterion for an incremental cancer risk of 10^{-6} (2.0 ug/l). Benzene was detected in the March groundwater samples from well LF 2-1 at a concentration of 18 ug/l. This concentration is well below the drinking water limit of 4,500 ug/l recommended by Sax (1979). Ethyl benzene was detected in well LF2-3 in March 1984 at a concentration of 8 ug/l. This is above the EPA ambient criterion of 1.4 ug/l but well below the EPA criterion for acute toxicity to freshwater aquatic life, 32,000 ug/l. The toluene concentration in the March sample from surface water station LF2-4 (36 ug/l) exceeds the EPA ambient criterion of 14.3 ug/l but is well below the EPA criterion for acute toxicity to freshwater aquatic life (17,500 ug/l).

Concentrations of total phenolics in the six Zone 5 samples range from 2 to 10 ug/l. Concentrations in samples from well LF2-1 (10 ug/l) and surface water stations LF2-5 (4 ug/l) and LF2-6 (10 ug/l) exceed EPA criteria for specific phenolic compounds, specifically 2,4-dichlorophenol and phenol.

Cyanide was not detected in the March samples from Zone 5. Results of metals analyses on Zone 5 water samples indicate no significant contamination due to nickel, copper, lead, zinc, chromium, and cadmium. Lead, chromium, and cadmium were either not detected or below the primary mcl (50, 50, and 10 ug/l, respectively). Copper and zinc were either not

downward against the hydraulic gradient and have penetrated the confining bed beneath Landfill No. 4 and another confining bed deeper in the aquifer. The presence of contaminants that are denser than water in samples collected from wells in Zone 4 raises the possibility that vertical migration of "silver" may also be occurring in Zone 4.

2. Fuel was encountered in well LF1-3. Prior to initial bailing of the well, an estimated 2.3 feet of fuel was floating on the water within the casing. Oil and grease in the water sample from this well was also high (12 mg/l). The source of the fuel may be the former leak in the 4-inch supply line in the vicinity of Landfill No. 1 (Schroeder et al., 1982).
3. Significant amounts of volatile organic compounds are present in shallow groundwater within Zone 4. The presence of these compounds is indicated by TOX levels of 90 to 220 ug Cl⁻/l in the five monitoring wells and total purgeable organics concentrations of 950 ug/l in well LF1-3 for the March 1984 sample. VOA compounds account for 64 percent of the total purgeable organics concentrations in water from well LF1-3. The source of the VOA is most likely JP-4 spilled from the leaking supply line. Trichloroethene in samples from LF1-2 and LF1-3 occur in concentrations that exceed the EPA ambient criterion of zero for ingestion of water.
4. Total phenolic concentrations of 12 to 201 ug/l in the five wells indicate that EPA water quality criteria for specific phenolic compounds may be exceeded.
5. Cyanide concentrations for the March 1984 samples from wells LF1-1, LF1-3, and LF1-4 range from 165 to 275 ug/l and exceed the EPA ambient criterion (200 ug/l) and/or the EPA maximum concentration for protection of freshwater aquatic life (52 ug/l).
6. Metals analyses for Zone 4 monitoring well samples indicate no significant contamination due to cadmium, chromium, copper, lead, nickel, and zinc.

1. The water-table aquifer in the vicinity of Fire Protection Training Area No. 2 is contaminated with high concentrations of solvents, lead, and oil as indicated by analyses for well FPT2-1. Contamination of the water-table aquifer extends at least as far as well FPT2-2 (55 feet from well FPT2-1) since "solvent" or "fuel" odors were noted in the water-table aquifer during construction of well FPT2-2 which was completed in an artesian aquifer.
2. Although the vertical hydraulic gradient favors a low rate of seepage (0.02 gallons per year per square foot) from the water-table aquifer to the next lower (confined) aquifer, groundwater from well FPT2-2 contained no detectable concentrations of lead or solvents. The pH of water from well FPT2-2 was remarkably high in December 1983 (9.8) but was lower (5.7) in March 1984; the lower pH is within the typical range (3.7 to 7.5) of pH in the Macon area (LeGrand, 1962).
3. December 1983 data for water supply well WS-12 which samples a confined aquifer included positive results for TOX and phenolics. The concentration of phenolics (10 ug/l) in WS-12 may exceed the EPA ambient criteria for 2,4,6-trichlorophenol (0 ug/l), 2,4-dichlorophenol (3.09 ug/l), or pentachlorophenol (3.5 ug/l).

4.3.4 Zone 4, Landfill No. 1 and JP-4 Spill Site

Based on analyses from five monitoring wells within the zone and geological information obtained during well installation, the following significant findings are reported:

1. Soils underlying Zone 4 will retard but not prevent migration of contaminants from shallow groundwater in the zone either laterally or vertically. Though clay and sandy clay lenses do exist beneath the zone, these strata are not continuous (Figures 24 and 25). As discussed in Sections 4.2.1 and 4.3.1, analytical results from separate wells screened above and below confining layers in Zone 1 indicate that organic contaminants are moving

phenolics and specific phenolics would be required to determine the true range of natural background for phenolics.

4.3.2 Zone 2, DDT Spill Site

The uppermost aquifer at this site is a perched water table supported by a clay lens 45 feet beneath land surface. Surface water runoff from Zone 2 is directed by the railroad ditch (Figure 7) to a drainage way leading to Duck Lake (Figure 20).

Results of analyses for this site determined:

1. High concentrations of DDT and chlordane are present in soil samples taken from the railroad ditch. DDT concentrations in the ditch varied from approximately 1,300 ug/kg to 227,000 ug/kg, while chlordane concentrations varied from approximately 15,000 ug/kg to 251,000 ug/kg. This threatens water quality and fish quality in Duck Lake.
2. Analyses of groundwater from well DDT-1 detected low concentrations of pesticides but not DDT. Chlordane was detected (0.04 ug/l) in the March 1984 sample. This concentration exceeds the 10^{-6} incremental increase of cancer risk EPA water quality criterion of 0.00046 ug/l (EPA, 1980). However, contaminants in the perched water table will probably be attenuated by soils materials before groundwater from this site could seep to the closest water supply well, which is WS-5 (Figure 19). Therefore, Zone 2 poses no immediate practical threat to potable water supplies.

4.3.3 Zone 3, Fire Protection Training Area No.2

The water-table aquifer beneath Zone 3 is approximately 15 feet thick and is separated from the next lower aquifer by over 30 feet of stiff clay. Luna Lake, just west of Zone 3 (Figure 8), is a man-made lake which is maintained with groundwater from water supply well WS-12.

Significant findings for this zone are as follows:

TOX (260 ug Cl⁻/l), and nickel (27 ug/l). Although this concentration of nickel exceeds the EPA human health criterion (13.4 ug/l), it is possible that 27 ug/l nickel may be within the range of natural background for this area since this value is not much greater than the detection limit for nickel (20 ug/l). Samples from three wells (of 25 analyzed for nickel) contained detectable concentrations of nickel (23, 27, and 28 ug/l); the other 22 samples had results of <20 ug/l nickel. Contamination in the upgradient well is probably related to infiltration of contaminants from the built-up area west of well LF4-13.

4. Groundwater from the wells along Hannah Road (LF4-1, LF4-2, W-15, and W-18) yielded positive results for phenolics, and the sample from well W-18 was apparently contaminated by halogenated organic compounds (TOX = 430 ug Cl⁻/l).
5. Since Landfill No. 4 is in a swamp, some, possibly all, of the phenolics may be attributable to naturally occurring phenolics, but additional analyses for specific phenolics would be required to test this possibility. Phenolics concentrations at the landfill perimeter in the Landfill Closure Report (LETCO, 1980) varied from 4 to 1,900 ug/l with two values exceeding 100 ug/l (360 and 1,900 ug/l) (see p. B-3). LETCO detected one specific phenolic compound (phenol) in priority pollutant analyses for wells W-4 and W-5 (990 and 110 ug/l, respectively) which had phenolics (total, nonspecific) concentrations of 93 and 1,900 ug/l, respectively. The other two wells tested by LETCO for specific phenolics (W-15 and W-18) had negative results on the priority pollutant scan for phenolics (p. B-4), but total phenolics either undetected (<2 ug/l) or measured at slightly above the detection limit (3 ug/l). These limited data may suggest that background concentrations of naturally occurring phenolics are approximately 3 ug/l or less and that concentrations of total phenolics much higher than this are indicative of synthetic phenolics; however, additional analyses for total

east. For example, the December 1983 vertical hydraulic gradients were approximately 0.005 at the Sludge Lagoon, 0.008 at the toe of Landfill No. 4, and 0.049 at Hannah Road. The horizontal hydraulic gradient in this area may be derived from the water level contour maps (Figures 21 and 22) and is approximately 0.003. The horizontal flow direction indicated by the contours is generally from west to east.

Significant findings for Zone 1 are as follows:

1. Groundwater in the vicinity of Landfill No. 4 and the Sludge Lagoon is contaminated by high concentrations of solvents. Groundwater contamination is also indicated by analyses for TOX, DOC, phenolics, and cyanide. This is consistent with the findings of the landfill closure report for this zone (LETCO, 1980).
2. Contaminants have migrated vertically into the aquifer beneath Zone 1. In doing so, these contaminants have moved against the vertical hydraulic gradient and have passed through zones of relatively low hydraulic conductivity. Leakage of contaminants through the peat and organic, silty clays beneath Landfill No. 4 may be due, in part, to some of the contaminants being denser than water (e.g., trichloroethene) which causes them to "sink" in the aquifer. In addition, the problem of vertical migration may have been exacerbated by monitor well construction techniques used during the landfill closure study in 1979 (LETCO, 1980). The well logs from that study (Appendix K) reveal that wells W-4, W-5, W-7, and W-9 fully penetrate both landfill materials and the underlying confining bed. The other wells (Figure 6) fully penetrate the waste materials but were completed in the underlying confining bed. There is no evidence that pit casings were employed in any of these wells; therefore, it is possible that leachate may migrate down through the filter pack of these wells.
3. Groundwater collected from the upgradient well (LF4-13) had at least low levels of contamination as indicated by analyses for

compositing the samples could have diluted contaminants from any given well to a concentration below the detection limit.

Purgeable organics were detected in samples from wells WS-3 and WS-8 in March 1984 (Table 31). Chloroform was detected in the March sample from well WS-8 and thus exceeds the EPA water quality criterion of 0 ug/l for human health; however, it is below the THM standard for drinking water (Table 13). In the March 1984 priority pollutant scan (Table 31), concentrations of chloroform (50 ug/l) and bromodichloromethane (14 ug/l) were higher than concentrations of these compounds (chloroform, 2 to 4 ug/l; bromodichloromethane, not detected) in discrete samples from the wells (Table 32). This may be the result of contamination of the composite sample by solvent vapors in the laboratory or during the act of compositing the sample.

The pesticide and base/neutral portions of the organic priority pollutant scan (Table 31) were below detection limits in March 1984.

In summary, total phenolics data for water supply wells WS-3, WS-6, and WS-8 may exceed EPA water quality criteria for specific phenolic compounds (Table 14). Solvents were detected in wells WS-3 and WS-8 in March 1984. Trichloroethene in WS-3 exceeded the EPA ambient criterion (0 ug/l) in the March sample. Chloroform in WS-8 also exceeded the EPA ambient criterion (0 ug/l) but did not exceed the THM standard (100 ug/l).

4.3 SIGNIFICANCE OF FINDINGS

4.3.1 Zone 1, Landfill No. 4 and Sludge Lagoon

This study site is in a swampy area and is underlain by deposits of peat and organic, silty clays (Figures 23 and 24). The organic soils beneath the landfill are in turn underlain by sands with interbedded clay. Vertical hydraulic gradients in this zone are indicative of artesian conditions and favor discharge of groundwater into surface water of the swamp. The vertical hydraulic gradients tend to increase from west to

Table 32. Results of Analyses of Environmental Samples Collected from Water Supply Wells WS-3, WS-6, and WS-8, Robins AFB, Georgia, March 1984

Parameter	WS-3	WS-6	WS-8
pH	6.0	5.8	8.4
Sp. Cond. @ 25°C (umhos/cm)	78	52	131
Cyanide (ug/l)	<10	<10	<10
<u>Volatile Halocarbons-All Units ug/l</u>			
Bromodichloromethane	<1	<1	<1
Bromoform	<1	<1	<1
Bromomethane	<1	<1	<1
Carbon tetrachloride	<1	<1	<1
Chlorobenzene	<1	<1	<1
Chloroethane	<1	<1	<1
2-Chloroethylvinyl ether	<1	<1	<1
Chloroform	4	<1	2
Chloromethane	<1	<1	<1
Dibromochloromethane	<1	<1	<1
1,2-Dichlorobenzene	<1	<1	<1
1,3-Dichlorobenzene	<1	<1	<1
1,4-Dichlorobenzene	<1	<1	<1
Dichlorodifluoromethane	<1	<1	<1
1,1-Dichloroethane	<1	<1	<1
1,2-Dichloroethane	<0.1	<0.1	<0.1
1,1-Dichloroethene	<1	<1	<1
Trans-1,2-Dichloroethene	<1	<1	<1
1,2-Dichloropropane	<1	<1	<1
Cis-1,3-Dichloropropene	<1	<1	<1
Trans-1,3-Dichloropropene	<1	<1	<1
Methylene chloride	<1	<1	<1
1,1,2,2-Tetrachloroethane	<1	<1	<1
1,1,1-Trichloroethane	<1	<1	<1
1,1,2-Trichloroethane	<1	<1	<1
Trichloroethene	<1	<1	<1
Trichlorofluoromethane	<1	<1	<1
Vinyl chloride	<1	<1	<1
<u>Volatile Aromatics-All Units ug/l</u>			
Benzene	<0.7	<0.7	<0.7
Ethyl benzene	<1	<1	<1
Toluene	<1	<1	<1

Table 31. Results of Analyses of Composite Sample of Water Supply
 Wells WS-3, WS-6, and WS-8, Robins AFB, Georgia, March 1984
 (Page 4 of 4)

Parameter	March 1984
<u>Base/Neutrals (ug/l)</u>	
3,3-Dichlorobenzidine	<1.0
Chrysene	<1.0
bis (2-Ethylhexyl) phthalate	<1.0
Di-n-octylphthalate	<1.0
Benzo (b) fluoranthene	<1.0
Benzo (k) fluoranthene	<1.0
Benzo (a) pyrene	<1.0
Indeno (1,2,3-c,d) pyrene	<2.5
Dibenzo (a,h) anthracene	<2.5
Benzo (g,h,i) perylene	<2.5

Table 31. Results of Analyses of Composite Sample of Water Supply
 Wells WS-3, WS-6, and WS-8, Robins AFB, Georgia, March 1984
 (Page 3 of 4)

Parameter	March 1984
<u>Base/Neutrals (ug/l)</u>	
N-nitrosodimethylamine	<1.0
bis (2-Chloroethyl) Ether	<1.0
1,3-Dichlorobenzene	<1.0
1,4-Dichlorobenzene	<1.0
1,2-Dichlorobenzene	<1.0
bis (2-Chloroisopropyl) ether	<1.0
Hexachloroethane	<1.0
N-nitrosodi-n-propylamine	<1.0
Nitrobenzene	<1.0
Isophorone	<1.0
bis (2-Chloroethoxy) methane	<1.0
1,2,4-Trichlorobenzene	<1.0
Naphthalene	<1.0
Hexachlorobutadiene	<1.0
Hexachlorocyclopentadiene	<1.0
2-Chloronaphthalene	<1.0
Dimethylphthalate	<1.0
Acenaphthylene	<1.0
2,6-Dinitrotoluene	<1.0
Acenaphthene	<1.0
2,4-Dinitrotoluene	<1.0
Diethylphthalate	<1.0
Fluorene	<1.0
4-Chlorophenyl phenyl ether	<1.0
Diphenylamine (N-nitroso)	<1.0
1,2-Diphenylhydrazine (Azobenzene)	<1.0
4-Bromophenyl phenyl ether	<1.0
Hexachlorobenzene	<1.0
Phenanthrene	<1.0
Anthracene	<1.0
Di-n-butylphthalate	1.0
Fluoranthene	<1.0
Benzidine	<1.0
Pyrene	<1.0
Butylbenzylphthalate	<1.0
Benzo(a)anthracene	<1.0

Table 31. Results of Analyses of Composite Sample of Water Supply
 Wells WS-3, WS-6, and WS-8, Robins AFB, Georgia, March 1984
 (Page 2 of 4)

Parameter	March 1984
<u>Pesticides/PCBs (ug/l)</u>	
Aldrin	<0.004
Alpha-BHC	<0.003
Beta-BHC	<0.006
Gamma-BHC	<0.004
Delta-BHC	<0.009
Chlordane	<0.014
4,4'--DDT	<0.012
4,4'-DDE	<0.004
4,4'-DDD	<0.011
Dieldrin	<0.002
Alpha-Endosulfan	<0.014
Beta-Endosulfan	<0.004
Endosulfan sulfate	<0.066
Endrin	<0.006
Endrin aldehyde	<0.023
Heptachlor	<0.003
Heptachlor epoxide	<0.083
PCB-1242	<0.050
PCB-1254	<0.050
PCB-1221	<0.10
PCB-1232	<0.050
PCB-1248	<0.050
PCB-1260	<0.050
PCB-1016	<0.10
Toxaphene	<0.24
<u>Phenolics (ug/l)</u>	
Phenol	<2.5
2-Chlorophenol	<2.5
2-Nitrophenol	<2.5
2,4-Dimethylphenol	<2.5
2,4-Dichlorophenol	<2.5
p-Chloro-m-cresol	<2.5
2,4,6-Trichlorophenol	<2.5
2,4-Dinitrophenol	<25
4-Nitrophenol	<2.5
4,6-Dinitro-o-cresol	<25
Pentachlorophenol	<2.5

Table 31. Results of Analyses of Composite Sample of Water Supply
 Wells WS-3, WS-6, and WS-8, Robins AFB, Georgia, March 1984
 (Page 1 of 4)

Parameter	March 1984
<u>Volatile Organics (ug/l)</u>	
Acrolein	<50
Acrylonitrile	<50
Benzene	<0.7
Bromodichloromethane	14
Bromoform	<1
Bromomethane	<1
Carbon tetrachloride	<1
Chlorobenzene	<1
Chloroethane	<1
2-Chloroethylvinyl ether	<1
Chloroform	50
Chloromethane	<1
Dibromochloromethane	<1
1,1-Dichloroethane	<0.1
1,2-Dichloroethane	<1
1,1-Dichloroethene	<1
Trans-1,2-Dichloroethene	<1
1,2-Dichloropropane	<1
Cis-1,3-Dichloropropene	<1
Trans-1,3-Dichloropropene	<1
Methylene chloride	3
1,1,2,2-Tetrachloroethane	<1
Tetrachloroethene	<1
1,1,1-Trichloroethane	<1
1,1,2-Trichloroethane	<1
Trichloroethene	<1
Trichlorofluoromethane	<1
Vinyl chloride	<1
Ethyl benzene	<1
Toluene	<1

Table 30. Results of Analyses of Environmental Samples Collected from Water Supply Wells WS-3, WS-6, and WS-8, Robins AFB, December 1983

Station No.	Matrix	pH	Sp. Cond. @ 25°C (umhos/cm)	DOC (mg/l)	Phenolics (mg/l)	Nickel (ug/l)	Copper (ug/l)	Lead (ug/l)	Zinc (ug/l)	Chromium (ug/l)	Cadmium (ug/l)
WS-3	GW	5.0	16	<0.3	5	<20	14	39	136	<10	<5
WS-6	GW	6.5	75	<0.3	2	<20	18	<30	39	<10	<5
WS-8	GW	NA	NA	<0.3	2	<20	<5	<30	20	<10	<5

GW = Groundwater.

NA = Not analyzed.

Table 28. Results of Analyses of Environmental Samples Collected in the Vicinity of the Hazardous Waste Burial Site (Zone 6), Robins AFB, Georgia, December 1983

Station No.	Matrix	pH	Sp. Cond. @ 25°C (umhos/cm)	Hg (ug/l)
HW-1	GW	4.8	21	<0.2

GW = Groundwater.

Table 29. Results of Analyses of Environmental Samples Collected in the Vicinity of the Hazardous Waste Burial Site (Zone 6), Robins AFB, Georgia, March 1984

Station No.	Matrix	pH	Sp. Cond. @ 25°C (umhos/cm)	DDT (ug/l)	PCB (ug/l)	Hg (ug/l)
HW-1	GW	4.1	33	<0.02	<0.25	NA

GW = Groundwater.

NA = Not analyzed.

detected or below the secondary mcl (1,000 and 5,000 ug/l, respectively). Detection limits for each metal were lower than the respective mcl. Nickel was not detected in any of the six samples. The detection limit reported for nickel is 20 ug/l.

In summary, contamination in shallow groundwater and surface water in Zone 5 is indicated by the presence of TOX, purgeable organics, and phenolics in nearly all water samples. Concentrations of specific purgeable organic compounds exceeded EPA ambient water quality criteria in some instances. Results of metals analyses indicated no significant contamination due to cadmium, chromium, copper, lead, nickel, or zinc.

4.2.6 Zone 6, Hazardous Waste Burial Site

Mercury (Table 28) PCBs were below detection limits in groundwater from Zone 6. Although an earlier sample of groundwater from Zone 6 detected DDT-R at a concentration close to the analytical detection limit, the March groundwater sample contained no detectable DDT-R (Table 29).

4.2.7 Water Supply Wells WS-3, WS-6, and WS-8

Analyses of water (Tables 30 to 32) from these wells (Figure 19) indicated low levels of contamination from phenolics and purgeable organics. Low concentrations of copper (14 and 18 ug/l), lead (39 ug/l), and zinc (20 to 136 ug/l) were detected but are well within drinking water standards. An organic priority pollutant scan of a composite sample (Table 31) from these three wells was performed using GC techniques in accordance with the scope of work (Appendix E).

The test for phenolics (Table 30) measured concentrations of 2 to 5 ug/l. These concentrations exceed the former EPA criterion for drinking water of 1 ug/l (EPA, 1976) and may exceed existing criteria for specific phenolic compounds. No specific phenolic compounds were detected in the March priority pollutant scan, but this is not conclusive evidence of the absence of these compounds from wells WS-3, WS-6, or WS-8 since

4.3.5 Zone 5, Landfill No. 2 and Fire Training Area No. 1

Based on analyses of samples from three monitoring wells and three surface water stations within the zone and geological information obtained during well installation, the following significant findings are reported:

1. Soils underlying Zone 4 will retard but not prevent migration of contaminants from shallow groundwater in the zone either laterally or vertically, for reasons discussed in Section 4.3.4(1).
2. Significant amounts of volatile organic compounds are present in shallow groundwater and surface water within Zone 5. The presence of these compounds is indicated by TOX concentrations of 110 to 490 ug Cl⁻/l in all six samples and total detectable purgeable organics concentrations of 103 to 5,340 ug/l in all samples except for the surface water sample at station LF2-5. The source of TOX is probably waste solvents, since 96 to 100 percent of the detectable total purgeable organic compounds in the samples are VOH. Purgeable organics may be entering the two streams adjacent to the landfill via runoff from areas upstream of Landfill No. 2, in addition to runoff and infiltration from Landfill No. 2. The presence of purgeable organics in shallow groundwater of Zone 5 may be a result of past fire training activities in the area.
3. Total phenolic concentrations of 2 to 10 ug/l in the six samples indicate that EPA water quality criteria for specific phenolic compounds may be exceeded.
4. Analyses for cyanide in Zone 5 water samples indicate no significant contamination.
5. Metals analyses for Zone 5 groundwater and surface water samples indicate no significant contamination due to cadmium, chromium, copper, lead, nickel, and zinc.

4.3.6 Zone 6, Hazardous Waste Burial Site

It is probable that the site does not pose a significant threat to human health or the environment for the following reasons:

1. Only a small quantity of wastes was disposed of at Zone 6, and according to information contained in the Phase I report (Schroeder, et al., 1982), all wastes buried at Zone 6 were encapsulated in concrete before burial.
2. The uppermost aquifer at this site is a perched water table supported by a clay lens at approximately 35 feet below land surface. Since perched water tables are typically limited in extent, well HW-1 samples groundwater that is unlikely to be used for human consumption. As water from the perched water table seeps deeper into the earth, any contained contaminants would be further attenuated by clay minerals.
3. No existing water supply wells on Robins AFB are downgradient of Zone 6.

4.3.7 Water Supply Wells WS-3, WS-6, and WS-8

Of these water supply wells, WS-3 is closest to Phase II, Stage 1 study sites (Zones 1, 4, and 5). The closest of these is Zone 4 (Landfill No. 1 and the JP-4 spill site). Significant findings for well WS-3 are as follows:

1. Chloroform (4 ug/l) was detected in the March sample at a concentration that exceeds the EPA ambient criterion of zero, but this value is below the total THM mcl of 100 ug/l.
2. Total phenolics in well WS-3 (5 ug/l) exceed EPA ambient criteria for specific phenolic compounds listed in Table 14. Phenolics data in the priority pollutant scan (Table 31) are inconclusive because of the dilution caused by compositing.
3. Contaminants in well WS-3 may have come from the nearby landfills or from the nearby industrial activities at Robins AFB.

Water supply well WS-6 is in a residential area well upgradient of the Phase II, Stage 1 study sites. Significant findings for this well are:

1. No solvents were detected in March 1984, but considering all data for the water supply wells, additional analyses for purgeable organics may be warranted.
2. Total phenolics (2 ug/l) may exceed EPA ambient water quality criteria for specific phenolic compounds listed in Table 14.

Water supply well WS-8 is northeast of, but not directly downgradient of, all Phase II, Stage 1 study sites. Consequently, it is unlikely that contaminants detected in samples from WS-8 are attributable to the Phase II, Stage 1 study sites. Significant findings for this well are similar to those for WS-6:

1. Chloroform was detected in the March sample (2 ug/l); this concentration exceeds EPA ambient water quality criteria (Table 14) but is less than EPA drinking water standards (Table 13) for total THMs; and
2. Total phenolics (2 ug/l) may exceed EPA ambient water quality criteria for specific phenolic compounds (Table 14).

5.0 ALTERNATIVE MEASURES

5.0 ALTERNATIVE MEASURES

Three alternatives are possible for the sites investigated:

1. Mitigate the contamination;
2. Conduct further monitoring to determine the need, if any, of cleanup; or
3. Take no further action.

Alternative 1 is appropriate where there is clear indication that present or future human or environmental problems will exist. The priority for actions would depend on the magnitude of the threat and whether that threat was current or future.

Alternative 2 is appropriate where insufficient evidence exists to place a site in either the Alternative 1 or 3 categories, or where additional information is needed for design of mitigative measures. Continued monitoring may be performed to better define the nature of contamination, to better define the extent of contamination, or to detect the spread of contamination. The goal should be to gather enough evidence in a timely manner to resolve the question of whether or not the site should be cleaned up.

Alternative 3 is appropriate for sites where there is little, if any, evidence to indicate that the site is or will ever be a source of significant contamination. This is a difficult decision since one can never be absolutely sure that no problem will ever exist at a site. However, reasonable judgments must be made so that resources can be allocated to sites that have the highest potential for environmental degradation.

5.1 MITIGATIVE MEASURES

Recommendations concerning mitigative measures are beyond the scope of the present study (OEHL, 1983); however, studies which do address mitigative measures should consider Zones 1, 2, 3, 4, and 5.

5.2 ADDITIONAL MONITORING

5.2.1 Zone 1, Landfill No. 4 and Sludge Lagoon

Continued monitoring in Zone 1 could be directed toward goals of better defining the nature of contamination or better defining the vertical and lateral extent of contamination, or both.

Since nonspecific analyses (TOX, phenolics, and DOC) for this zone were positive for one or more samples, one option would be expanding the list of analyses to better define the nature of contamination. Analyses for all organic priority pollutants (listed in Table 39) should help accomplish this aim. However, since LETCO's (1980) priority pollutant scans detected only solvents, phenolics, and phthalates, it would be reasonable to add only the acid extractable and base/neutral portions of the list.

Contaminants have migrated vertically to at least 100 feet below land surface at Landfill No. 4, but the question of the full extent of vertical migration remains unanswered. Installation of deeper wells adjacent to the present cluster wells would help resolve this question; although it could take several iterations to produce a fully satisfactory answer.

Definition of the lateral extent of contaminants from Zone 1 would involve installing wells in the swamp between Landfill No. 4 and Hannah Road. The maximum horizontal distance groundwater could have traveled since the beginning of Landfill No. 4 (1965) may be estimated from the hydraulic gradient (I) at the site (approximately 0.003), representative values of hydraulic conductivity (K) for fine to medium sand [2.5 to 12 m/d (Todd, 1980)], and representative values of specific yield (S_y) for fine to medium sand [23 percent to 28 percent (Todd, 1980)]. This distance (D) for the lifetime of the landfill (t) is given by the relation $D = (KI/S_y)t$. These values yield a range of approximate distances of 750 to 3,000 feet. For comparison, Hannah Road is approximately 1,300 feet from the downgradient edge of Landfill No. 4 and approximately 2,300 feet from the Sludge Lagoon. Siting of additional wells should be based upon an improved estimate of the foregoing kind.

based upon field measurements of hydraulic conductivity and consideration of expanded analyses of the Hannah Road wells. It should be recognized that pollutant migration rates are generally less than groundwater seepage velocities since contaminants are attenuated by adsorption, to varying degrees, during passage through an aquifer.

Since the drainage ditch north of Zone 1 is another route for contaminant migration from this site, the extent of contamination along the ditch is another possibility for investigation.

5.2.2 Zone 2, DDT Spill Site

The primary concern at this site is the potential for migration of chlordane to Duck Lake and concentration of this pesticide in fish. This possibility could be investigated by sampling fish from Duck Lake for chlordane analysis. The FDA action level for chlordane in fish flesh is 0.3 ppm (FDA, 1981). DDT migration is of lesser concern since past analyses have shown that DDT in fish taken from Duck Lake is below the FDA action level (see Section 1.3.2).

A second possibility for continued monitoring at the DDT spill site would be expanded soil sampling and analyses to determine the volume and extent of contaminated soil. This would be appropriate if contaminated soils were to be removed as part of a cleanup effort.

The third possibility for additional monitoring would be continued monitoring of groundwater from the site. However, this should not be a high priority due to the low concentrations of contaminants detected and the distance to the nearest water supply well.

5.2.3 Zone 3, Fire Protection Training Area No. 2

Alternatives for additional monitoring of this site include expanding the list of analyses and further monitoring of groundwater and surface water.

Expansion of the list of analyses should be based upon results for TOX in wells FPT2-2 and WS-12 and for phenolics in WS-12. These considerations would require that the list of analyses include a complete organic priority pollutant scan since TOX in wells FPT2-2 and WS-12 exceeded VOHs.

There is little point in continued monitoring of well FPT2-1 since it is so highly contaminated, but additional monitoring of well FPT2-2 would be advisable since there is a potential for vertical migration of contaminants, as discussed in Section 4.2.3. This well would serve as a "sentinel" to detect the spread of contamination into the next lower aquifer beneath Zone 3.

Sampling and analysis of surface water from Luna Lake would also be advisable to determine if contaminants from WS-12 have been pumped into the lake.

5.2.4 Zone 4, Landfill No. 1 and JP-4 Spill Site

Three primary objectives could be addressed by additional monitoring within Zone 4.

1. Define the areal extent and volume of the JP-4 spill.
2. Define the vertical and lateral extent of chemical contamination in the groundwater and the potential for further migration.
3. Better define the nature of contaminants.

A plan for additional monitoring of chemical contamination in Zone 1 groundwater should be designed to better define the nature of contamination, the vertical and lateral extent of contamination, and the potential for further migration. The first objective will require expanded sets of analyses to identify specific contaminants where nonspecific analyses such as TOX, DOC, and phenolics indicate the presence of contamination. Purgeable organic analyses were only performed on samples from two of the five monitoring wells. In well LFL-3, purgeable organics more than accounted for the TOX level reported for that well. However, purgeable organics accounted for only about 30 percent of the TOX reported for

well LF1-2. Analyses for total phenolics indicated phenolic contamination in all five monitoring wells. Based on these observations, the most thorough approach for additional monitoring would be to analyze all samples for the complete list of organic priority pollutants (purgeable organics, base/neutral extractable organics, acid extractable organics, and pesticides/PCBs) in addition to GWCI parameters. Since results from well LF1-3 indicate that purgeable organics account for all of the TOX reported at that location, a cost-effective approach would be to analyze samples for GWCI parameters, purgeable organics, and acid extractable organics. If TOX is not accounted for by these organic scans in all samples, subsequent analyses can be expanded to include base-neutral organics and eventually pesticides/PCBs if necessary.

All further monitoring should include analyses for cyanide since it was detected in significant concentrations in three of the five Zone 4 wells.

In order to determine the vertical and lateral extent of groundwater contamination, installation of additional wells will be required. Alternatives for locating these wells should be limited to the downgradient direction, as defined by existing water level information. Since wells already exist to monitor shallow groundwater downgradient from Zone 4, only deeper downgradient wells need to be installed. The best location for these wells is east-southeast of Landfill No. 1 on the southeast side of Second Street. A pair of wells with depths of 65 and 100 feet and screened throughout the lower 15 feet of each well will be adequate to assess downward migration of contaminants. Deeper wells can be installed if contamination is found in these wells. An additional cluster of wells with depths of 30, 65, and 100 feet (screened throughout the lower 15 feet) installed east of Hannah Road 800 feet south of its intersection with Second Street will provide distant downgradient monitoring for Zones 4 and 5.

Using the method discussed in Section 5.2.1, the range of maximum potential distances for migration of contamination from Zone 4 can be estimated as 1,200 feet to 7,100 feet. This estimate may be improved by performing field measurements of hydraulic conductivity in future studies.

5.2.5 Zone 5, Landfill No. 2 and Fire Training Area No. 1

Possible objectives for additional monitoring within Zone 5 are:

1. Definition of the vertical and lateral extent of chemical contamination in the groundwater;
2. Estimation of contaminant migration from the zone via surface and groundwater; and
3. Better determination of the nature of contaminants.

Data for Zone 5 surface water and groundwater indicate that significant contamination within the zone is limited to purgeable organics and possibly phenolic compounds. The Phase I records search indicates that significant quantities of malathion were disposed of in Landfill No. 2. The appropriate analyses for subsequent monitoring in Zone 5 should include GWCI parameters, purgeable organics, acid extractable organics, and organophosphate pesticides.

In order to determine the vertical and lateral extent of groundwater contamination, an approach similar to that described in Section 5.2.4 for Zone 4 is desirable. Two additional deep wells adjacent to well LF2-1 will assess the downward migration of leachate from the zone. These wells should be 65 and 100 feet deep and screened throughout the lower 15 feet. These wells would also serve to some extent as a downgradient well for Zone 4. The three-well cluster east of Hannah Road described in Section 5.2.4 will serve as a distant downgradient well for Zones 4 and 5. Surface water samples should be collected from the same three locations as the Phase II, Stage 1 sampling program to assess migration of contamination from the zone via runoff or infiltration to the ditches. The range of maximum potential distances of migration of contamination

from Zone 5 via groundwater can be estimated from the relationship given in Section 5.2.1 as 1,100 feet to 6,400 feet. This estimate may be improved by performing field measurements of hydraulic conductivity in future studies.

5.2.6 Zone 6, Hazardous Waste Burial Site

There is little reason to continue monitoring Zone 6. However, since well HW-1 is also downgradient of the solid radioactive waste disposal site (Figure 10), this well could be incorporated in the annual monitoring program for radioactive wastes.

5.2.7 Water Supply Wells WS-3, WS-6, and WS-8

The nature of the apparent contamination by phenolics could be resolved by expanding the list of analyses to include the specific phenolics (acid extractables) on the priority pollutant list. Since well WS-3 is closest to the Phase II, Stage 1 study sites, it is the best candidate for continued monitoring within context of the IRP.

5.3 NO FURTHER STUDY

5.3.1 Zone 6, Hazardous Waste Burial Site

If two sets of samples from one well are representative of conditions at Zone 6, there is no need for continued monitoring of the Hazardous Waste Burial site.

6.0 RECOMMENDATIONS

6.0 RECOMMENDATIONS

Recommendations for continued monitoring for the Phase II, Stage 1 sites are presented in Sections 6.1 through 6.7.

6.1 ZONE 1, LANDFILL NO. 4 AND THE SLUDGE LAGOON

1. Seal and abandon monitor wells W-2 through W-11 in accordance with Georgia law since these wells penetrate the landfill without the protection of pit casings.
2. Expand the present list of analyses for this site by adding the acid extractable (phenolics) portion of the priority pollutant list.
3. Determine horizontal hydraulic conductivity of the sand aquifer underlying Zone 1 by conducting aquifer tests in downgradient wells.
4. Use the hydraulic conductivity value determined in item 3 to better define the maximum distance groundwater may have traveled since 1965. If this value and additional chemical data for the Hannah Road wells (see item 6 below) indicate that contaminants from the site have migrated beyond Hannah Road, install a cluster of three wells (30, 65, and 100 feet) an appropriate distance east of Hannah Road. PVC casing and screen (15 feet) may be used since the Hannah Road wells are still serviceable.
5. Install deeper wells at the Sludge Lagoon (one 100 feet and one 200 feet) and at the downgradient edge of Landfill No. 4 (one 200 feet) to further assess vertical migration of contaminants in Zone 1. Well design at these sites should incorporate stainless steel well casing and screen (15 feet) and black iron pit casings.
6. Sample wells LF4-1 through LF4-13, W-15 through W-19, and newly installed wells semiannually, and analyze groundwater for pH, specific conductance, TOX, DOC, total phenolics, cyanide, purgeable organics, and acid extractable organics.

7. Sample surface water stations LF4-14 through LF4-17. In addition, collect four samples from the drainage ditch north of Zone 1. These stations should be selected at points between the Sludge Lagoon and Horse Creek. Analyze surface water samples for the constituents in item 6 on a semiannual basis.

6.2 ZONE 2, DDT SPILL SITE

1. Continue annual monitoring of catfish from Duck Lake. Analyze composite samples for total DDT and chlordane.

6.3 ZONE 3, FIRE PROTECTION TRAINING AREA NO. 2

1. Determine what organic halides, if any, are causing high values of TOX in wells FPT2-2 and WS-12 by analyzing water from these wells for TOX and the organic priority pollutants.
2. Sample well FPT2-2 annually and perform analyses for pH, specific conductance, TOX, and purgeable organics.
3. Collect mid-depth surface water samples and sediment samples from two stations in Luna Lake. Analyze for pH, specific conductance, TOX, lead, and purgeable organics. If the analyses indicate contamination, continue analysis of Luna Lake samples on a semiannual basis.

6.4 ZONE 4, LANDFILL NO. 1 AND JP-4 SPILL SITE

1. Determine the areal extent and thickness of the JP-4 spill by:
 - a. Conducting a soil vapor investigation to define the probable areal extent of free-floating product, and
 - b. Installing shallow monitor wells (10 feet, fully screened) to confirm the results of the soil vapor survey.
2. Install two wells to depths of 65 and 100 feet (screened throughout the lower 15 feet) east-southeast of Landfill No. 1 on the southeast side of Second Street.
3. Install a cluster of three wells with depths of 30, 65, and 100 feet (screened throughout the lower 15 feet) east of Hannah Road 800 feet south of its intersection with Second Street.

TABLE B-4.

**Priority Pollutant Analysis by
Stewart Laboratories**

Concentrations reported in parts per billion (ppb).

NOTE: * Indicates non-priority pollutant detected, but not quantified.

TABLE V
SUMMARY OF WATER CHEMISTRY LABORATORY DATA
BY LETCO LABORATORY

LEGEND

Page 1 • Multigrade Best Teacher

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micrograms per liter

TABLE B-2.

METHANE GAS ENCOUNTERED AT AUGER BORING LOCATIONS

<u>BORING NO.</u>	<u>LOCATION</u>	<u>DEPTH</u>	<u>CH₄, % TOTAL GAS</u>
A-1	Area B	5'	40
		10'	75
		15'	Off Scale
		20'	Off Scale
A-2	Area A	5'	25
		10'	62
		15'	Off Scale

: Auger Borings and Gas Monitoring Performed December 12, 1979.
 Instrument Utilized: MSA Gascope (c)

TABLE B-1.
SUMMARY OF MONITORING WELL INFORMATION
(ALL MEASUREMENTS IN FEET)

<u>NO.</u>	<u>PIPE ELEV.</u>	<u>PIPE HEIGHT</u>	<u>GROUND SURF EL.</u>	<u>GW DEPTH*</u>	<u>GW ELEV.</u>
-1	256.61	1.55	255.06	4.19	250.87
-2	256.46	1.90	254.56	5.58	248.98
-3	257.73	1.80	255.93	7.42	248.51
-4	258.89	1.85	257.04	8.69	248.35
-5	259.22	1.75	257.47	7.63	249.84
-6	254.49	1.35	253.14	3.04	250.10
-7	254.54	1.60	252.92	2.70	250.22
-8	256.39	2.10	254.29	3.94	250.35
-9	-	-	260.9	10.5	250.4
10	263.65	0.65	263.00	10.75	252.25
-11	263.63	1.05	262.58	9.46	253.12
-12	257.42	1.85	255.57	3.83	251.74
-13	253.75	2.15	251.60	1.46	250.14
-14	254.45	1.80	252.65	4.75	247.90
-15	251.84	1.90	249.94	4.11	245.83
-16	251.66	1.95	249.71	3.71	246.00
-17	250.28	2.45	247.83	1.00	246.83
-18	252.10	2.00	250.10	4.59	245.61
-19	252.00	3.50	248.50	2.37	246.13

<u>INTER BORING NO.</u>	<u>GROUND SURF. EL.***</u>	<u>GW DEPTH</u>	<u>GW ELEV.</u>
-1	259.8	8.8	251.0
-2	259.4	5.9	253.5

Ground-water depths measured March 17, 1980

Well W-9 was destroyed by construction equipment. The elevations shown are estimates based on interpolation from available topographic data.

Interpolated

APPENDIX B
LANDFILL CLOSURE REPORT DATA
(LETCO, 1980)

LIST OF ABBREVIATIONS/ACRONYMS
(Page 2 of 2)

NPDES	National Pollutant Discharge Elimination System
OEHL	Occupational and Environmental Health Laboratory
OD	Outside diameter
ppm	Parts per million
PCB	Polychlorinated biphenyl
PVC	Polyvinyl chloride
ppb	Parts per billion
QA/QC	Quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
SCS	Soil Conservation Service
STP	Sanitary sewage treatment plant
ft ²	Square feet
TDS	Total dissolved solids
THM	Trihalomethanes
TSI	Technical Services, Inc.
TOC	Total organic carbon
TOX	Total organic halogens
USAF	United States Air Force
USDA	United States Department of Agriculture
EPA	U.S. Environmental Protection Agency
UBTL	Utah Biomedical Testing Labs
VOA	Volatile aromatics
VOH	Volatile halocarbons
yd	Yard
WAR	Water and Air Research, Inc.

LIST OF ABBREVIATIONS/ACRONYMS
(Page 1 of 2)

AFB	Air Force Base
ASTM	American Society for Testing Materials
BES	Bioenvironmental Engineering Services
cm	Centimeter
Cl/l	Chlorine per liter
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
yd ³	Cubic yard
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DOD	Department of Defense
DOC	Dissolved organic carbon
DDT	Dichlorodiphenyltrichloroethane
DDT-R	DDT breakdown products
FAA	Federal Aviation Administration
ft	Feet
FDA	Food and Drug Administration
GC	Gas chromatograph
gal	Gallon
gpd	Gallons per day
gpd/ft ²	Gallons per day per square foot
gpm	Gallons per minute
GPR	Ground-penetrating radar
GC/MS	Gas Chromatograph/Mass Spectrometer
GWCI	Groundwater contamination indicators
GWQR	Georgia Water Quality Regulations
HARM	Hazardous assessment rating methodology
HSA	Hollow-stem auger
H.P.	Horse power
hr	Hour
in	Inch
ID	Inside diameter
IRP	Installation Restoration Program
LETCO	Law Engineering Testing Company
max.	Maximum
mcl	Maximum contaminant level
msl	Mean sea level
m/d	Meters per day
ug Cl ⁻ /l	Micrograms of chloride per liter
ug/g	Micrograms per gram
ug/kg	Micrograms per kilogram
ug/l	Micrograms per liter
umhos/cm	Micromhos per centimeter
mg/kg	Milligrams per kilogram
mg/l	Milligrams per liter
min.	Minimum

APPENDIX A
LIST OF ABBREVIATIONS/ACRONYMS

APPENDICES

U.S. Environmental Protection Agency (EPA). 1975. Manual of Water Well Construction Practices. EPA-570/9-75-001. U.S. Government Printing Office, 156 p, Washington, D.C.

U.S. Environmental Protection Agency (EPA). 1977. Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities. EPA/530/SW-611. Cincinnati, Ohio. 269 p.

U.S. Environmental Protection Agency (EPA). 1980. Water Quality Criteria Documents; Availability. Federal Register, Volume 45, No. 231. November 28, 1980. pp. 79318-79379.

Walton, W.C. 1970. Groundwater Resource Evaluation. McGraw-Hill Book Company, New York, New York. 664 p.

Water and Air Research, Inc. (WAR). 1980. Final Contract Report, Engineering and Environmental Study of DDT Contamination of Huntsville Spring Branch, Indian Creek, and Adjacent Lands and Waters, Volume 2 of 3. U.S. Army Corps of Engineers, Mobile District. Contract No. DACW01-79-C-0224.

Water and Air Research, Inc. (WAR) 1982. Scope of Work for Conducting Phase II Installation Restoration Work at Robins Air Force Base, Georgia. Prepared for U.S. Air Force, OEHL, Brooks Air Force Base, Texas. F33615-81-D-4007-0005.

Winn, M. 1984. Personal Communication. Georgia Department of Natural Resources, Water Quality Section, Atlanta, Georgia.

Wooten, R.C., USAF OEHL. 1985. Telephone conversation with W.C. Zegel, March 12, 1985.

Occupational and Environmental Health Laboratory (OEHL). 1985.
Consolidated Comments on Robins AFB Installation Restoration Program
Second Draft Report.

Payne, S. 1984. Personal Communication. Bioenvironmental
Engineering Service Division, Robins Air Force Base, Georgia.

Pollard, L.D., and R.C. Vorhis. 1980. The Geohydrology of the
Cretaceous Aquifer System in Georgia. Georgia Geological Hydrologic
Atlas Number 3.

Rizzo, J. 1982. Personal Communication. Technos, Inc., Miami,
Florida.

Roberts, P.V., P.L. McCarty, M. Reinhard, and J. Schreiner. 1980.
Organic Contaminant Behavior During Ground-Water Recharge. Journal
Water Pollution Control Federation, Volume 52, No. 1, January, pp.
161-171.

Sax, N.I. 1979. Dangerous Properties of Industrial Materials, Fifth
Edition. Van Nostrand Reinhold Co., New York, New York.

Sax, N.I., Editor. 1982. Dangerous Properties of Industrial Materials
Report. Volume 2, No. 4, July/August 1982. Van Nostrand Reinhold
Co., New York, New York.

Sax, N.I., Editor. 1983. Dangerous Properties of Industrial Materials
Report, Volume 3, No. 1, January/February 1983. Van Nostrand
Reinhold Co., New York, New York.

Schroeder, E.J., G.M. Gibbons, R.M. Reynolds, M.I. Spiegel, and
R.E. Zimmerman. 1982. Installation Restoration Program, Phase
I--Records Search, Robins Air Force Base, Georgia. Prepared for
U.S. Air Force, AFESC/DEV, Tyndall Air Force Base, Florida.
Contract No. F08637-80-0009.

Sonderegger, J.L., L.D. Pollard, and C.W. Cressler. 1978. Quality and
Availability of Groundwater in Georgia. Georgia Geological Survey
Information Circular 48.

Talley, et al. 1979. Non-Potable Water Chemical Testing 1978-1979.
Bioenvironmental Engineering Services Division, U.S. Air Force.
Robins Air Force Base, Georgia.

Tinsley, I.J. 1979. Chemical Concepts in Pollutant Behavior.
Wiley-Interscience. New York, New York, p 265.

Thomson, M.T., S.M. Herrick, and E. Brown. 1956. The Availability and
Use of Water in Georgia. Georgia Geological Survey Bulletin 65.

Todd, D.K. 1980. Groundwater Hydrology. John Wiley & Sons, New York.
535 p.

7.0 REFERENCES

- Barcelona, M.J., J.A. Helfrich, E.E. Garsko, and J.P. Giff. 1984. A Laboratory Evaluation of Ground Water Sampling Mechanisms. *Ground Water Monitoring Review*. Volume 4, No. 2, pp. 32-41.
- Brown, K.W. 1982. "Landfills of the Future," press release. Soil and Crop Sciences Department, Texas A&M University, College Station, Texas.
- Chow, V.T.. 1964. *Handbook of Applied Hydrology*, McGraw-Hill Book Company, New York, New York.
- Fernstrom, J. 1984. Personal Communication. Georgia Department of Natural Resources, Groundwater Section, Atlanta, Georgia.
- Food and Drug Administration (FDA). 1981. Action Levels for Poisonous or Deleterious Substances in Human Food and Animal Feed. Washington, D.C.
- Freeze, R.A., and J.A. Cherry. 1979. *Groundwater*. Prentice-Hall, Inc. Englewood Cliffs, New Jersey. 604 p.
- Giger, W. and E. Molnar-Kubica. 1978. Tetrachloroethylene in Contaminated Ground and Drinking Waters. *Bulletin Environmental Contamination Toxicology*, Volume 19, No. 4, April, pp. 475-480.
- Grim, R.E. 1968. *Clay Mineralogy*. McGraw-Hill Book Company, New York, New York. p 596.
- Herrick, S.M. 1961. *Well Logs of the Coastal Plain of Georgia*. Georgia Geological Survey Bulletin Number 70.
- Herrick, S.M. 1965. *A Subsurface Study of Pleistocene Deposition Coastal Georgia*. Georgia Geological Survey Information Circular 31.
- Herrick, S.M., and R.C. Vorhis. 1963. *Subsurface Geology of the Georgia Coastal Plain*. Georgia Geological Survey Information Circular 25.
- Law Engineering Testing Company (LETCO). 1980. Final Report, Ground Water Monitoring Program, Landfill Closure, Robins Air Force Base, Warner Robins, Georgia.
- LeGrand, H.E. 1962. *Geology and Ground Water Resources of the Macon Area, Georgia*. Georgia Geological Survey Bulletin Number 72.
- Mitchell, G.D. 1979. *Potentiometric Surface of the Principal Artesian Aquifer in Georgia*. Georgia Geological Survey Hydrologic Atlas Number 4.
- Occupational and Environmental Health Laboratory (OEHL). 1983. Installation Restoration Program (IRP) Phase IIB and IIC Report Format. Brooks Air Force Base, Texas.

7.0 REFERENCES

4. Analyze water samples from these wells and the five wells installed in Zone 4 for the Phase II, Stage 1 survey at 6-month intervals for the following parameters: pH, specific conductance, DOC, TOX, cyanide, total phenolics, purgeable organics, and acid extractable organics. If the purgeable and acid extractable organic scans do not account for the TOX, base/neutral extractable organics and pesticide/PCB scans may be added to the analyses. A water sample from Robins AFB water supply well WS-3 should be analyzed for the above parameters.

6.5 ZONE 5, LANDFILL NO. 2 AND FIRE TRAINING AREA NO. 1

1. Install two wells adjacent to well LF2-1 to depths of 65 and 100 feet. These wells should be screened throughout the lower 15 feet.
2. Analyze water samples from the above two wells; wells LF2-1, LF2-2, and LF2-3; and surface water stations LF2-4, LF2-5, and LF2-6 for the following parameters at 6-month intervals: pH, specific conductance, DOC, TOX, total phenolics, purgeable organics, acid extractable organics, and organophosphate pesticides. If malathion is detected in significant concentrations in any of these wells, the cluster of wells east of Hannah Road (described in Section 6.4) should be sampled for organophosphate pesticides in subsequent sampling.

6.6 ZONE 6, HAZARDOUS WASTE BURIAL SITE

1. Incorporate well HW-1 into the annual monitoring program for the low level radioactive waste disposal site. Analyze groundwater samples for radium and gross alpha particle radioactivity.

6.7 WATER SUPPLY WELLS WS-3, WS-6, AND WS-8

1. Monitor water quality from well WS-3 in conjunction with continued monitoring of Zones 1, 4, and 5. Analyze samples semiannually for constituents recommended for Zone 4.
2. Monitor all three wells for purgeable organics and phenolics semiannually.

TABLE B-5.
 Pesticide and Poly-chlorinated Biphenyl
 Analysis by Riverbend Research
 Center, University of Georgia

PARAMETER	Sampling Point	CONCENTRATION			
		Downstream Surface Sample S-2	Monitoring Wells at Landfill Perimeter W-4	Monitoring Wells W-5	Downgradient Monitoring Wells W-15 W-18
Aldrin		ND	ND	ND	ND
Chlordane		ND	ND	ND	ND
DDD		ND	ND	ND	ND
DDF		ND	ND	ND	ND
DDT		ND	ND	ND	ND
Dieldrin		ND	ND	ND	ND
Endrin		ND	ND	ND	ND
Ethion		ND	ND	ND	ND
Heptachlor		ND	ND	ND	ND
Heptachlor Epoxide		ND	ND	ND	ND
Lindane		ND	ND	ND	ND
Malachite		ND	ND	ND	ND
Methoxychlor		ND	ND	ND	ND
Methyl Parathion		ND	ND	ND	ND
Mirex		ND	ND	ND	ND
Parathion		ND	ND	ND	ND
PCB 1242		ND	ND	ND	ND
PCB 1154		ND	ND	ND	ND
PCB 1260		ND	ND	ND	ND
Tetraphene		ND	ND	ND	ND

NOTE: Analysis of Samples S-2 and Sample W-5 indicated presence of one or more unidentified organic compounds.

APPENDIX C
STAFF RESUMES

WILLIAM D. ADAMS

HYDROGEOLOGIST
WATER AND AIR RESEARCH, INC.

Relevant Experience

Mr. Adams is a graduate geologist who has specialized in engineering applications of hydrogeology. His practical experience is strongly oriented toward solving problems of pollutant transport in the subsurface environment.

He works on environmental contamination assessments and hazardous waste management/ permitting. He has conducted hydrogeologic work at abandoned hazardous waste sites at DOD installations in Alabama, Florida, North Carolina, Georgia, Virginia, Missouri, and Arizona. At some of these bases, chemical agent disposal was investigated and elaborate health and safety precautions were used.

His project responsibilities have included: assembling and reviewing geologic and geohydrologic literature; quantifying pollutant movement potential using published documents and/or field test data; supervising monitoring well installation; selecting well sites, depths, and casing requirements; specifying rig cleanup procedures; and drafting reports of findings for DOD and regulatory staffs. Mr. Adams has also participated in staff briefings detailing interim and final findings.

He conducted a comprehensive hazardous waste inspection and survey at Pensacola Naval Air Station. Industrial facilities which generate substantial quantities of various wastes were visited and associated personnel debriefed to determine waste generation and handling practices. This information was used in two ways. First, Mr. Adams and his team developed a complete hazardous waste management plan for the entire complex. This ensured compliance with 40 CFR 260-265. A Part B permit application, including revised Part A, was then filed. Facilities permitted included container storage buildings, surface impoundments, and treatment in drying beds. A preliminary design for additional container storage was reviewed and concept design modifications made to ensure RCRA compliance (40 CFR 264). Although numerous tanks were used, all tank usage was reviewed and recommendations were made to alter hazardous waste storage practices. This eliminated the need to permit any tank.

Mr. Adams has directed field work for installation restoration confirmation studies (Phase 2) at five Air Force Bases (three in Florida), and one Army Ammunition Plant. In these studies, he researched site geology, sited all wells, supervised well installation and development, and collected samples for inorganic and organic constituent analyses.

In another DOD study, Mr. Adams compared two potential depleted uranium burial sites. He planned and supervised the field work, lab work, and report preparation. An important aspect of this study was assessing potential routes of contaminant migration. This work included extensive field and laboratory soils testing and analysis.

Education

M.S.	Geology	University of Florida
B.S.	Geology	University of Florida

Professional Societies

National Water Well Association
Florida Water Well Association

Publications

Author and co-author of several articles and numerous technical reports.

ROBERT D. BAKER, JR.

ENVIRONMENTAL CHEMIST
WATER AND AIR RESEARCH, INC.

Relevant Experience

Mr. Baker is a highly skilled organic chemist who has diverse experience in analyzing environmental samples for various organic constituents. Examples of his recent work include:

- o Gas chromatographic (GC) analysis using FID, ECD, NPD, FPD, and Hall ECD and high-pressure liquid chromatographic (HPLC) analysis using variable wavelength UV/visible, fluorescence, and electrochemical detectors; and
- o Developing and testing methods for analysis for determining trace levels of organic contaminants in pesticide industry wastestreams, which included, among other analyses, detecting phenolics and volatiles using GC.

In work related to other pesticide manufacturers, he reviewed and assessed processes for more than 200 compounds. Using plant operating data, he identified possible impurities introduced through raw materials, by-products created from side-reactions, and potential contamination from various solvent media. This work ultimately led to development of pretreatment technologies.

Mr. Baker modified existing methods of analyzing for DDT in natural waters. Modification was necessary to meet extremely low detection limits with rigorous quality control because of low concentrations mandated in drinking water regulations.

Other types of analytic work by Mr. Baker include:

- o Analyzing natural water (river and lake) samples for organics for background EIS data--Georgia, South Carolina, Alabama, and Florida;
- o Analyzing water and sediment samples for low levels of DDT, PCBs, and other organics--Alabama and Virginia;
- o Developing improved techniques to accurately measure volatile hydrocarbon levels in soils--Virginia;
- o Analyzing fish tissue for hazardous waste contamination in blinded samples with better than 90-percent accuracy on duplicates and controls--Alabama;
- o Using HPLC to verify methods for analysis of 16 polynuclear aromatic hydrocarbon compounds and 2 benzidine compounds (wastewater matrix)--Ohio; and
- o Using HPLC to develop methods and analyze for hazardous (munitions) wastes--Louisiana and Texas.

Education

B.S. Chemistry Northeast Louisiana University

Professional Societies

American Chemical Society
American Association for the Advancement of Science

CHARLES R. FELLOWS

ENVIRONMENTAL CHEMIST
WATER AND AIR RESEARCH, INC.

Relevant Experience

Mr. Fellows is an environmental chemist trained in both field studies and formal laboratory chemistry.

As a member of hazardous waste site investigation teams, Mr. Fellows has conducted interviews regarding past disposal practices, past and present industrial/chemical processes, and the chemical and physical nature of disposed materials. On several occasions he has identified waste sites that posed an immediate concern to human health.

Mr. Fellows is familiar with and has used various appropriate safety procedures and techniques while sampling sites that have received hazardous wastes. He has collected groundwater, surface water, sediment, and leachates for a wide variety of organic, inorganic, and physical analyses. He is experienced in applying site assessment models to evaluate migration and health-threatening potential of chemical wastes at specific disposal sites.

In addition to the procedures mentioned above for collection, preservation, and analysis of various types of samples, he is familiar with the RCRA EP Toxicity Test Procedure, the U.S. Army Corps of Engineers Elutriate Test Procedure, and groundwater monitoring procedures for arsenic, heavy metals and other toxicants.

Mr. Fellows is directly responsible for inorganic chemical analyses. He performs quality assurance checks and often participates in actual laboratory water quality analyses. He recently worked with an industry generating hazardous wastes to develop suitable extraction methods for assessing waste toxicity. He helped to develop wastewater analysis protocols which mitigated interferences from chemicals in battery manufacturing wastes.

He directs sampling of groundwater monitoring wells and participates in developing field sampling networks for both surface waters and groundwaters.

Education

M.S.	Water Chemistry	University of Florida
B.S.	Biology	Eckerd College

Publications

Author and co-author of several articles and technical reports

JAMES H. SULLIVAN, JR., Ph.D., P.E.

ENVIRONMENTAL ENGINEER
WATER AND AIR RESEARCH, INC.

Relevant Experience

Dr. Sullivan has played major roles in projects involving technical work directly related to groundwater monitoring and assessment at hazardous wastes sites. His recent experience includes work for a paper manufacturer, a phosphate plant, a landfill, and a cement manufacturer.

Dr. Sullivan directed preparation of Part A and Part B permit applications for the U.S. Navy. He has also worked directly on other projects related to RCRA groundwater monitoring and assessment programs and the permitting process. He is familiar with the DOD Hazardous Materials Information System which he has used to assess chemical/physical properties of DOD compounds. He directed a team of scientists and engineers working at two installations on initial assessment studies (IASS) for the U.S. Naval Energy and Environmental Support Activity (NEESA). Potential for contamination from past hazardous waste disposal was determined for approximately 80 candidate disposal sites. Recommendations for confirmation or remedial action were developed.

At U.S. Air Force bases he conducted Phase 2 Confirmation Studies of potential contamination from past hazardous waste disposal activities. He participated in field work and used field data to assess pollutant movement and severity of contamination. He recommended remedial measures and specified additional data needs for remedial design.

He directed a series of studies for the U.S. Army in which impacts of munitions wastes at several ammunition plants were defined. Siting of a new munitions plant was the objective of another study, and developing water quality criteria for hazardous substances using field and laboratory data was accomplished in another study. He conducted field work, data reduction, report preparation and briefings.

At a U.S. Army installation (Redstone Arsenal), Dr. Sullivan directed a nationally prominent study of environmental contamination from DDT. He was responsible for devising and evaluating engineering techniques for remedial action. The project involved several public agencies, with field data collected by four separate groups. He was responsible for reducing and interpreting all field data. Again he participated directly in field reconnaissance, records research, data compilation, data reduction, report writing, and briefings, including those before Congressional staffs.

Dr. Sullivan studied three solid waste disposal sites near Charleston, South Carolina and monitored groundwater impacts. In addition to gathering chemical data on groundwater and soils, fluorescent dye was used to trace groundwater movement. Evidence of hazardous substances in leachate was found and remedial action recommended.

Education

Ph.D.	Environmental Engineering	University of Florida
M.S.	Environmental Engineering	University of Florida
B.S.	Chemical Engineering	Georgia Institute of Technology

Professional Registrations and Society Memberships

Professional Engineer--Florida
Member of 8 professional societies

Publications

Author and co-author of approximately 10 publications and 45 technical reports in water chemistry, potable water treatment, wastewater renovation, and environmental impact assessment.

WILLIAM G. THIESS

ENVIRONMENTAL ENGINEER
WATER AND AIR RESEARCH, INC.

Relevant Experience

Mr. Thiess has worked with hazardous waste management at facilities in Georgia, Florida, Alabama, and Texas. He prepared major portions of a Part B application for a commercial treatment, storage, and disposal facility in Georgia. He developed concept designs for container storage and sludge fixation (solidification) facilities. He developed all topographic information and process descriptions, and he designed plans for waste storage and handling.

Mr. Thiess prepared major portions of a Part B application for a Naval Air Station in Texas. He helped develop plans and specifications for a container storage building and vaulted, below-grade storage tanks. He prepared detailed facility descriptions. He has interfaced directly with permit agency staff to negotiate permit conditions.

Mr. Thiess has participated in initial assessment studies (IASSs) of hazardous waste contamination at U.S. Marine Corps and U.S. Navy installations. For a naval shipyard, he was also responsible for developing recommendations for further groundwater assessment and remedial actions where contamination was apparent.

Mr. Thiess evaluated engineering alternatives for isolation or detoxification of DDT-contaminated sediments near Huntsville, Alabama. His primary role in this project was to select, design, and cost various mitigation alternatives. He also helped evaluate relative alternative effectiveness.

In another groundwater contamination study near Redstone Arsenal (Alabama), he supervised well sampling and laboratory analysis of hazardous organics according to rigid field and laboratory procedures.

For the U.S. Army Corps of Engineers (COE), Mobile District, he directed efforts to identify and assess impacts upon physical systems for the Coosa River Navigation Project environmental impact statement. For Savannah District, he supervised and participated in field work and data analysis for the Richard B. Russell Dam pre-impoundment study.

He has participated in and directed portions of Section 208 projects in central Florida. He developed water and nutrient budgets for the Winter Haven chain of lakes in a study designed to evaluate restoration alternatives for Lake Howard. He was also responsible for design and implementation of a study to evaluate effects of septic tank drainfields on water quality in three central Florida lakes.

While a graduate research assistant at Clemson University (1978-1979), he was responsible for organizing and directing stream survey field work for a project sponsored by the U.S. Environmental Protection Agency (EPA) designed to evaluate the effectiveness of control measures for nonpoint source pollutants. He supervised laboratory work in sediment transport analysis and applied various digital computer models to drainage basins for erosion and sediment transport analysis. He dealt with various state and federal agency personnel, as well as local interests, during organization and implementation of the project.

Education

M.S. Environmental Systems Engineering
B.S. Environmental Engineering Technology

Clemson University
Florida Institute of Technology

Professional Organizations

Chi Epsilon
Water Pollution Control Federation
American Water Works Association

WILLIAM C. ZEGEL, Sc.D., P.E.

CHEMICAL ENGINEER
WATER AND AIR RESEARCH, INC.

Relevant Experience

Dr. Zegel is a chemical engineer trained in process control and environmental impact assessments. Dr. Zegel participated in an on-site investigation of hazardous waste disposal at a major military shipyard. Using his expertise in chemical processes, he reviewed industrial activities and assessed potential waste generation. He interviewed shop personnel and visited waste disposal sites. He then developed work scopes to assess pollutant movement from significant sites.

In other hazardous waste work, he developed major portions of RCRA Part B permit applications for an air station in Texas. Facilities included storage in tanks and containers. Plans and specifications were developed in support of the application. He authored a technical paper regarding Part B permitting preparation and presented it at a major national hazardous waste conference. He also directed a major Air Pollution Control Association (APCA) specialty conference on control of toxic pollutants.

For Estech General Chemicals Company, Dr. Zegel performed a process analysis for a proposed phosphate mine which uses a unique approach to clay dewatering in the beneficiation process. This included developing historic data relating to the proposed process, acquiring process data on existing processes, and running pilot-scale tests of the proposed process. Results were included in prepared documents and successfully defended during expert witness testimony at administrative hearings.

He directed an investigation of controlling hazardous emissions for the coil coating industry, including analysis of fume incinerators. This led to descriptions of waste streams and potential environmental impacts and was accomplished long before similar actions were required by U.S. Environmental Protection Agency (EPA) regulations. In a study of phosphoric acid production processes in Florida, he developed detailed descriptions of chemical mechanisms and substances. Waste streams were then identified, characterized, and quantified.

Education

Sc.D.	Chemical Engineering	Stevens Institute of Technology
M.S.	Chemical Engineering	Stevens Institute of Technology
B.S.	Chemical Engineering	Stevens Institute of Technology

Awards and Citations

Who's Who in the South, Who's Who in Engineering, American Men and Women of Science

Professional Registrations

Professional Engineer--Florida, Alabama, Georgia, Illinois, and Missouri
FES Certificate of Continued Professional Development

Publications

Approximately 25 publications and patents in molecular sieve technology sludge conditioning, flocculation, phosphate removal, algal culturing, air pollution measurement and control, control of organics in drinking water, instrument design, environmental impact process, and project management. Contributing author for the 3-volume Environmental Engineer's Handbook.

APPENDIX D
ENVIRONMENTAL DATA SUMMARIES FROM
THE PHASE I REPORT
(Schroeder et al., 1982)

TABLE D-1.
THREATENED OR ENDANGERED VERTEBRATE SPECIES
POTENTIALLY FOUND WITHIN
ROBINS AIR FORCE BASE

Common Name	Status	Habitat
<u>Fish</u>		
Suwannee Bass	Threatened	Unpolluted springs & rivers
Trispot Darter	Threatened	Unpolluted streams
<u>Reptiles and Amphibians</u>		
American Alligator	Endangered	Coastal plain swamps & bayous
Pine Barrens Tree Frog	Threatened	Pine barren swamps
<u>Birds</u>		
Southern Bald Eagle	Endangered	Estuarine shores, rivers
Florida Sandhill Crane	Threatened	Wet prairies and fields
Ivory-Billed Woodpecker	Endangered	Bottom land hardwood stands
Red-Cockaded Woodpecker	Endangered	Old-age pine woodlands
Bachman's Warbler	Endangered	River swamp forest
<u>Mammals</u>		
Florida Panther	Endangered	Large, unmolested swamp, deer available

Source: Robins AFB TAB A-2, Updated 1976
 Verified and updated by Georgia Game and Fish Division, 1982

TABLE D-2.
1981 NPDES DATA SUMMARY

Station/Parameter	Unit	Permit Requirement	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
<u>Station 001 (Runoff Ditch by Missile Storage)</u>													
BOD	mg/l	10.0	5.8	4.7	2.5	2.4	1.6	1.5	2.6	5.1	4.3	2.3	2.5
	mg/l	15.0	3.1	0.6	1.5	1.0	1.3	5.4	2.3	10.3	3.1	2.7	4.8
Oil/Grease													
Suspended Solids	mg/l	50.0	--	6.0	4.5	1.3	1.2	--	1.6	3.2	2.4	1.0	2.7
pH	unit	6.0-8.5	6.7	6.9	6.2	6.8	7.3	7.7	7.1	6.9	7.2	6.7	6.7
<u>Station 002 (Runoff Ditch by Ammo Storage Area)</u>													
BOD	mg/l	15.0	8.0	6.3	6.9	3.8	3.0	1.9	1.4	4.1	3.5	2.7	2.2
	mg/l	15.0	4.6	0.6	1.2	1.9	2.9	3.9	4.1	9.1	5.4	3.8	4.2
Oil/Grease	unit	6.0-8.5	6.6	6.9	8.5	7.3	7.2	7.4	7.4	7.0	6.8	7.4	6.6
pH													
<u>Station 003 (Runoff Ditch North SAC Alert)</u>													
BOD	mg/l	15.0	7.0	4.3	3.2	2.5	3.0	1.3	2.0	4.1	2.5	2.6	1.8
	mg/l	15.0	3.0	0.8	2.1	1.3	1.7	2.1	1.7	11.0	2.6	3.1	8.4
Oil/Grease	unit	6.0-8.5	6.7	10.3	7.2	6.5	7.3	7.2	7.6	7.3	8.0	6.9	6.7
pH													
<u>Station 004 (Hannah Rand Runoff Ditch)</u>													
BOD	mg/l	15.0	5.1	2.4	3.7	2.3	1.8	2.0	1.6	1.6	2.5	1.3	2.0
	mg/l	15.0	1.8	0.3	1.3	1.5	3.4	1.2	2.9	2.9	6.2	4.7	4.6
Oil/Grease	unit	6.0-8.5	6.5	7.1	7.1	6.9	7.1	7.1	7.1	6.9	6.7	6.9	6.5
pH													
NH ₃ -N	mg/l	2.0	0.56	0.28	0.8	0.3	0.5	1.4	0.56	1.8	0.001	2.4	0.3

(Continued)
1981 NPDES DATA SUMMARY

Station/Parameter	Unit	Permit Requirement	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
<u>Station 005 (Ditch at End of S... Treat. Plant No. 2 Pipe)</u>													
BOD	mg/l	15.0	3.5	3.5	3.7	3.4	2.7	2.4	2.4	4.9	3.0	2.9	2.5
Oil/Grease	mg/l	15.0	1.8	0.1	1.6	2.5	2.1	1.6	4.8	3.7	4.1	4.4	3.2
pH	unit	6.0-8.5	6.9	6.7	6.7	7.1	7.2	7.2	7.2	6.9	7.0	7.1	6.6
NH ₃ -N	mg/l	2.0	0.42	1.12	0.56	0.2	0.92	0.56	0.56	0.84	0.001	0.28	0.2
<u>Station 006 (Ditch by Dependent Pool)</u>													
BOD	mg/l	15.0	4.7	3.9	3.6	2.9	2.4	1.8	1.4	4.6	1.4	2.8	1.7
Oil/Grease	mg/l	15.0	2.3	0.4	1.4	1.0	4.3	1.5	1.3	2.7	5.2	6.8	3.1
pH	unit	6.0-8.5	7.3	6.4	6.8	6.9	7.4	7.2	7.9	7.4	7.3	6.9	7.0
<u>Station 008 (Industrial Waste Treatment Plant #2)</u>													
BOD	mg/l	30.0	2.1	2.3	3.2	1.3	3.3	1.7	6.8	3.7	3.1	3.1	2.9
Suspended Solids	mg/l	30.0	13.0	18.0	7.9	6.0	5.8	9.9	5.8	8.4	10.0	7.6	6.8
COD	mg/l	150.0	40.0	50.0	38.0	20.0	48.0	60.0	61.0	60.2	55.0	60.0	40.0
Oil/Grease	mg/l	15.0	1.1	1.8	9.4	4.1	6.3	9.0	4.4	6.4	3.1	8.0	6.1
Phenol	mg/l	0.2	0.02	0.2	0.19	0.2	0.1	0.2	0.1	0.1	0.001	0.01	0.01
Cyanide	mg/l	0.35	0.04	0.04	0.05	0.06	0.05	0.1	0.04	0.05	0.03	0.04	0.05
Cadmium	mg/l	0.15	0.02	0.02	0.03	0.02	0.08	0.05	0.02	0.13	0.02	0.02	0.01
Chromium (total)	mg/l	0.45	0.08	0.01	0.01	0.13	0.07	0.13	0.07	0.20	0.10	0.01	0.08
Zinc	mg/l	0.45	0.08	0.05	0.06	0.01	0.10	0.11	0.07	0.10	0.18	0.12	0.1
Nickel	mg/l	0.75	0.01	0.01	0.01	0.12	0.12	0.07	0.1	0.17	0.34	0.06	0.04
Lead	mg/l	0.15	0.01	0.01	0.01	0.01	0.02	0.05	0.01	0.10	0.08	0.1	
Copper	mg/l	0.30	0.02	0.04	0.2	0.02	0.18	0.10	0.07	0.3	0.04	0.07	0.08
pH	unit	6.0-9.0	8.8	8.8	8.3	8.9	8.6	8.8	9.0	9.0	9.0	9.0	8.1

TABLE D-2.

(Continued)
1981 NPDES DATA SUMMARY

Station/Parameter	Unit	Permit Requirement	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
<u>Station 009 (Industrial Waste Treatment Plant #1)</u>													
BOD	mg/l	Not Listed	16.0	20.0	23.0	27.0	21.0	25.0	19.0	18.0	15.0	8.0	8.0
COD	mg/l	"	39.0	50.0	44.0	10.0	32.0	20.0	50.0	31.0	31.4	20.0	20.0
Suspended Solids	mg/l	"	15.0	13.0	25.0	11.0	17.0	18.0	14.0	13.0	15.0	4.0	4.0
Phenol	mg/l	0.20	0.10	0.02	0.02	0.2	0.2	0.2	0.2	0.1	0.1	0.02	0.01
Oil/Grease	mg/l	15.0	0.90	0.2	1.1	2.0	1.6	1.5	4.7	2.3	2.1	2.1	3.0
NH ₃ -N	mg/l	2.0	0.28	0.56	0.77	1.1	0.6	1.6	0.28	1.8	0.001	0.56	0.2
Fecal Coliform	N/100 ml	400.0	1.0	200.0	131.00	1000	TNTC	219.0	1000	3500	5000	4.0	1.0
pH	Unit	6.0-9.0	7.5	7.9	7.3	7.0	7.4	7.4	7.3	7.2	7.3	7.2	

TNTC = too numerous to count

TABLE D-3.
 SUMMARY OF WATER SAMPLE RESULTS
 FROM MONITORING STATION NO. 001
 (Missile Storage Area)
 March 1979

Day	COD (mg/l)	TOC (mg/l)	Oil & Grease (mg/l)	Fe (μ g/l)	K (mg/l)	Na (mg/l)	CN (mg/l)
13	20	7	0.6	2,300	1.3	5.9	0.2
14	20	8	0.3	1,600	1.1	4.5	0.1
15	20	5	(a)	1,000	1.1	4.5	(b)
16	15	7	(a)	280	1.1	4.5	(b)
17	15	9	(a)	2,900	1.0	6.0	(b)
18	14	7	(a)	3,400	0.7	6.0	2.1

-) Less than detectable limits of 0.3 mg/l.
-) Less than detectable limits of 0.1 mg/l.
-) Results for the following parameters were less than the detectable limits shown:
 NH_3 (0.2 mg/l), PO_4 (0.2 mg/l), Cd(10 μ g/l), Cr^{+3} (50 μ g/l),
 Cr^{+6} (50 μ g/l), Cu(20 μ g/l), Pb(50 μ g/l), Hg(5 μ g/l), Ni(50 μ g/l)
 and Zn(50 g/l).

AD-A157 087

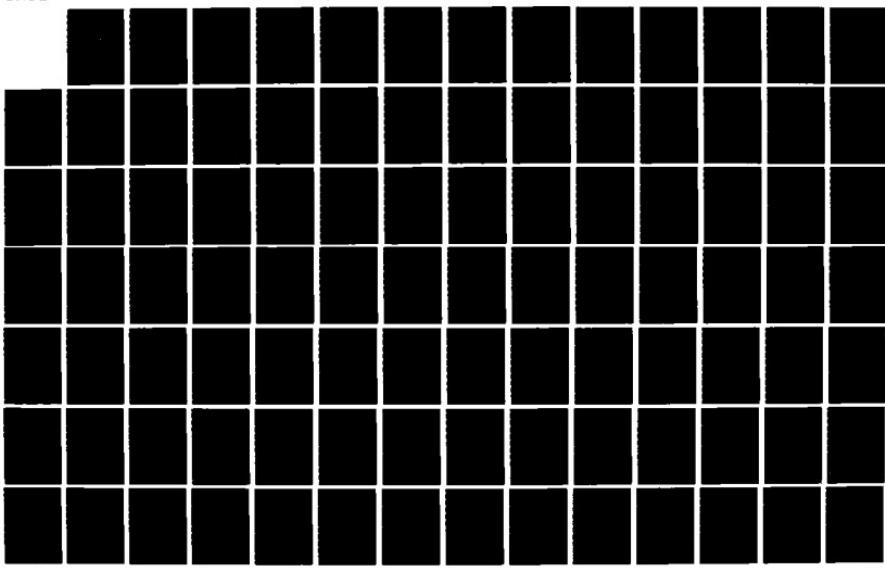
INSTALLATION RESTORATION PROGRAM PHASE
II--CONFIRMATION/QUANTIFICATION STAGE 1(U) WATER AND
AIR RESEARCH INC GAINESVILLE FL MAR 85

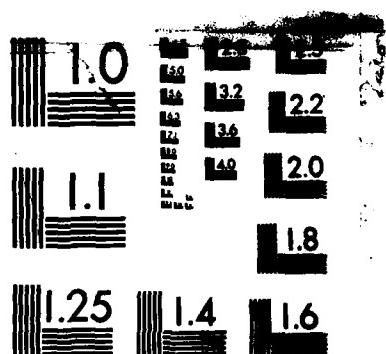
3/5

UNCLASSIFIED

F/G 13/2

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TABLE D-4.
SUMMARY OF WATER SAMPLE RESULTS FROM
MONITORING STATION NO. 002 (SAC DITCH), NOVEMBER 1978

Day	COO mg/l	TOC mg/l	Oil & Grease mg/l	Cd µg/l	Cr ⁺³ µg/l	Cu µg/l	Ag µg/l	Na mg/l	K mg/l	Zn µg/l	Temp. °F	pH S.U.	D.O. mg/l	NH ₃ mg/l	Cl ⁻ mg/l
15	11	1	(b)	31	100	38	28	28	1.6	100	68.9	7.2	8.0	0	0
16	6	(a)	(b)	15	(c)	30	(d)	54.3	1.3	140	68.9	6.8	7.0	0	0
17	5	(a)	(b)	19	58	27	(d)	16	0.4	84	68.9	7.2	6.5	0	0
18	11	(a)	(b)	25	(c)	29	(d)	.31	2.0	100	68	7.2	7.5	0	0
19	6	(a)	0.4	11	(c)	29	(d)	14.1	0.8	70	59	7.2	7.0	0	0
20	6	(a)	0.4	<10	(c)	40	(d)	2.2	0.5	70	62.6	7.0	7.5	0	0
21	6	1	(b)	41	(c)	35	(a)	65.5	1.3	95	66.2	7.0	7.0	0	0

- (a) Less than detectable limits of 1.0 mg/l
- (b) Less than detectable limits of 0.1 mg/l
- (c) Less than detectable limits of 50 µg/l
- (d) Less than detectable limits of 10 µg/l
- (e) Results for the following parameters were less than the detectable limits shown:
CN (0.1 mg/l), Phenol (0.1 mg/l), Cr⁺⁶ (50 µg/l), Pb (50 µg/l), Ni (50 µg/l),
Surfactants (0.1 mg/l).

TABLE D-5.

SUMMARY OF WATER SAMPLE RESULTS FROM
 MONITORING STATION NO. 004
 (Hannah Rd.,) February 1979

Day	pH	TDS (mg/l)	Cl^+ (mg/l)	Ca^{+2} (mg/l)	Mg^{+2} (mg/l)	Na^+ (mg/l)	K^+ (mg/l)	SO_4^{2-} (mg/l)	HCO_3^- (mg/l)	NO_3^- (mg/l)	NO_2^- (mg/l)	NH_4^+ (mg/l)	Cl^- (mg/l)	Hg^{+2} (mg/l)	Pb^{+2} (mg/l)	Cd^{+2} (mg/l)
1	8.0	35	6.0 (6)	6.0 (6)	1.0 (1)	6.0 (6)	0.0	24.3	170	1.0 (1)	1.0 (1)	4.0 (4)	1.0 (1)	1.0 (1)	0.0	0.05 (0.05)
2	8.0	25	6.0 (6)	6.0 (6)	1.0 (1)	6.0 (6)	0.0	24.0	150	1.0 (1)	1.0 (1)	4.0 (4)	1.0 (1)	1.0 (1)	0.0	0.05 (0.05)
3	8.0	3	6.0 (6)	6.0 (6)	1.0 (1)	6.0 (6)	0.0	24.3	160	1.0 (1)	1.0 (1)	4.0 (4)	1.0 (1)	1.0 (1)	0.0	0.05 (0.05)
4	8.0	11	6.0 (6)	6.0 (6)	1.0 (1)	6.0 (6)	0.0	24.4	150	1.0 (1)	1.0 (1)	4.0 (4)	1.0 (1)	1.0 (1)	0.0	0.05 (0.05)
5	8.0	35	6.0 (6)	6.0 (6)	1.0 (1)	6.0 (6)	0.0	24.4	150	1.0 (1)	1.0 (1)	4.0 (4)	1.0 (1)	1.0 (1)	0.0	0.05 (0.05)
6	8.0	1	6.0 (6)	6.0 (6)	1.0 (1)	6.0 (6)	0.0	24.4	150	1.0 (1)	1.0 (1)	4.0 (4)	1.0 (1)	1.0 (1)	0.0	0.05 (0.05)
7	8.0	35	6.0 (6)	6.0 (6)	1.0 (1)	6.0 (6)	0.0	24.4	150	1.0 (1)	1.0 (1)	4.0 (4)	1.0 (1)	1.0 (1)	0.0	0.05 (0.05)
8	8.0	10	6.0 (6)	6.0 (6)	1.0 (1)	6.0 (6)	0.0	24.4	150	1.0 (1)	1.0 (1)	4.0 (4)	1.0 (1)	1.0 (1)	0.0	0.05 (0.05)
9	8.0	12	6.0 (6)	6.0 (6)	1.0 (1)	6.0 (6)	0.0	24.4	150	1.0 (1)	1.0 (1)	4.0 (4)	1.0 (1)	1.0 (1)	0.0	0.05 (0.05)

(a) Less than detectable limits of 0.1 mg/l

(b) Exceeds works permit limits of 4.0 mg/l

(c) Exceeds permits limits of 0.2 mg/l

(d) Less than detectable limits of 0.1 mg/l

(e) Less than detectable limits of 0.0 mg/l

TABLE D-6.

SUMMARY OF WATER SAMPLE RESULTS FROM MONITORING STATION NO. 005
(Golf Course Lake), March 1979

Day	COD mg/l	TOC mg/l	Oil & Grease mg/l	PO ₄ mg/l	Cu μg/l	Fe μg/l	Ug μg/l	Zn μg/l	K μg/l	Na μg/l	Ca μg/l	CN μg/l
20	10	(a)	(b)	0.3	-	1,400	20	-	0.5	1.4	12.2	-
21	10	(a)	(b)	0.2	36	1,800	(d)	(e)	0.5	2.7	-	2.3
22	6	1	(b)	0.4	65	1,600	(d)	50	0.5	2.3	-	-
23	6	(a)	(b)	(c)	40	1,400	(d)	(e)	0.5	2.3	-	-
24	6	(a)	(b)	(c)	35	570	(d)	(e)	1.5	0.8	-	-
25	6	1	(b)	(c)	30	800	(d)	(e)	1.2	1.1	-	-
26	<5	(a)	5	(c)	<20	1,200	(d)	170	1.5	1.9	-	-

(a) Less than detectable limits of 1.0 mg/l

(b) Less than detectable limits of 0.3 mg/l

(c) Less than detectable limits of 0.2 mg/l

(d) Less than detectable limits of 5 μg/l

(e) Less than detectable limits of 50 μg/l

(f) Results for the following parameters were less than the detectable limits shown:
NH₃ (0.2 mg/l), Cd (10 μg/l), Cr⁺³ (50 μg/l), Cr⁺⁶ (50 μg/l), Pb (50 μg/l),
and Ni (50 μg/l).

TABLE D-7.
 SUMMARY OF WATER SAMPLE RESULTS FROM
 HORSE CREEK (HC) AND THE STABLE AREA (006)
 APRIL 1979

Day	COD (mg/l)	TOC (mg/l)	Oil & Grease (mg/l)
<u>Stable Area</u>			
2	15	5	(a)
3	(a)	4	(a)
4	(a)	4	(a)
5	10	4	(a)
6	6	3	(a)
7	6	(a)	(a)
8	6	3	(a)
<u>Horse Creek</u>			
9	15	0.7	(a)
10	10	3	(a)
11	15	4	(a)
12	5	4	(a)
13	5	5	(a)
14	10	5	(a)
15	5	3	(a)

- (a) Less than detectable limits of 0.3 mg/l.
- (b) Results for the following parameters were less than the detectable limits shown:
 NH_3 (0.2 mg/l), PO_4 (0.2 mg/l) and surfactants (0.1 mg/l).

TABLE D-8.
SUMMARY OF WATER SAMPLE RESULTS FROM
INDUSTRIAL WASTE TREATMENT PLANT ADDITION

Day	COD (mg/l)	TOC (mg/l)	NH ₃ (mg/l)	NO ₃ (mg/l)	PO ₄ (mg/l)	Surfac- tants (mg/l)	Phenol (mg/l)	CN (mg/l)	pH
1	30	13	7.2	0.5	3.1	0.2	0	0	7.2
2	10	2	3.2	1.9	3.5	0.1	0	0	7.4
3	30	13	8.0	0.3	4.1	0.1	0	0	7.2
4	28	13	4.0	0.8	3.5	0.1	0	0	7.4
5	28	11	3.5	1.0	2.8	0.2	0	0	7.2
6	15	10	2.5	1.2	2.5	0.1	0	0	7.4
7	30	13	4.0	0.9	2.0	0.2	0	0	7.2

- (a) Results for oil and greese were less than the detectable limit of 0.3 mg/l.
- (b) No sample results were given for the following parameters: Cd, Cr⁺³, Cr⁺⁶, Cu, Fe, Mn, Hg, Ni, Ag, Zn, Ca, Mg, K, Na, Cl⁻, SO₄

TABLE D-9.

SUMMARY OF WATER SAMPLE RESULTS FROM MAJOR BASE LAKES,
August 8 to October 13, 1978

	DUCK LAKE				LIMA LAKE				SCOUT LAKE			
	No. of Samples	Min.	Max.	Mean	No. of Samples	Min.	Max.	Mean	No. of Samples	Min.	Max.	Mean
Cu, $\mu\text{g/l}$	11	0	0	-	4	0	0	-	4	0	0	-
Cr ⁺⁶ , $\mu\text{g/l}$	11	0	0	-	4	0	0	-	4	0	0	-
Cr ⁺³ , $\mu\text{g/l}$	11	0	0	-	4	0	0	-	4	0	0	-
NH ₃ ⁻ , mg/l	11	0	0	-	4	0	0	-	4	0	0	-
NO ₃ ⁻ , mg/l	11	0	0	-	4	0	0	-	4	0	0	-
NO ₂ ⁻ , mg/l	11	0	0	-	4	0	0	-	4	0	0	-
PO ₄ ⁻³ , mg/l	11	0	0.4	0.12	4	0	0.18	0.05	4	0	0	-
Fe, $\mu\text{g/l}$	10	100	300	160	4	0	100	40	4	0	100	30
SO ₄ ⁻² , mg/l	10	0	0	-	4	0	0	-	4	0	0	-
Ca, mg/l	1	10	10	10	1	5	5	5	1	5	5	5
Cl ⁻ , mg/l	1	2.5	2.5	2.5	1	2.5	2.5	2.5	1	2.5	-	-
Pb, $\mu\text{g/l}$	10	6.8	8.0	7.1	1	5.5	5.5	5.5	1	-	-	-

TABLE D-10.

SUMMARY OF WATER SAMPLE RESULTS FROM THE WASTE TREATMENT PLANTS

August 8 - December 13, 1978

Station 009 (Ind. Waste Treat. Pit #1)				Station 005 (End of San. Treat. Pit. No. 2 Pipe)				Station 004 (Hannah Road Ditch)			
No. of Samples	Min.	Max.	Mean	No. of Samples	Min.	Max.	Mean	No. of Samples	Min.	Max.	Mean
Cu, $\mu\text{g}/\text{l}$	13	0	0	13	0	0	-	13	0	0	-
Cr ⁺⁶ , $\mu\text{g}/\text{l}$	13	0	0	13	0	0	-	13	0	0	-
Cr ⁺³ , $\mu\text{g}/\text{l}$	13	0	0	13	0	0	-	13	0	0	-
NH ₃ , mg/l	13	3	12.7	7.4	13	1.2	10.5	5.2	14	1.6	8.3
NO ₃ , mg/l	9	0.1	5.1	2.5	6	1	3	1.9	6	0.1	1.0
NO ₂ , mg/l	9	0.01	1.0	0.5	7	0.03	2.4	0.12	6	0	0.9
PO ₄ , mg/l	10	1.8	4.0	2.8	10	5	18	10.3	9	0.7	5.1
Fe, $\mu\text{g}/\text{l}$	12	200	500	370	13	50	210	130	9	0.6	1.2
SO ₄ , mg/l	6	40	80	65	7	15	18	15.4	6	20	50
Ca, mg/l	6	50	60	52.5	7	40	50	47.8	5	30	35
Cl, mg/l	7	18	30	22.3	7	20	25	22.8	5	25	30
Pb, $\mu\text{g}/\text{l}$	7	6.8	7.4	7.2	7	7.2	7.4	7.3	6	5.5	6.8

TABLE D-11.
EPA INTERIM PRIMARY AND PROPOSED SECONDARY
DRINKING WATER STANDARDS

PARAMETER	MAXIMUM LEVEL	
A. Interim Primary		
Arsenic	0.05	mg/l
Barium	1.0	mg/l
Cadmium	0.01	mg/l
Chromium (VI)	0.05	mg/l
Fluoride	1.4 to 2.4	mg/l
Lead	0.05	mg/l
Mercury	0.002	mg/l
Nitrate (as N)	10	mg/l
Selenium	0.01	mg/l
Silver	0.05	mg/l
Endrin	0.002	mg/l
Lindane	0.004	mg/l
Methoxychlor	0.1	mg/l
Toxyphene	0.005	mg/l
2,4-D	0.01	mg/l
2,4,5-TP Silvex	0.01	mg/l
Radium	5 pCi/l	
Gross Alpha	15 pCi/l	
Gross Beta	4 millirem/yr	
Turbidity	1 TU	
Coliform Bacteria	1/100 ml	
B. Secondary		
Chloride	250	mg/l
Copper	1	mg/l
Foaming Agents	0.5	mg/l
Hydrogen Sulfide	0.05	mg/l
Iron	0.3	mg/l
Manganese	0.05	mg/l
Sulfate	250	mg/l
Total Dissolved Solids	500	mg/l
Zinc	5	mg/l
Color	15 Color Units	
Corrosivity	Non-corrosive	
Odor	3 threshold Odor Number	
pH	6.5 to 8.5	

TABLE D-12.
ROBINS AIR FORCE BASE
CURRENT PESTICIDES USED

Insecticides	Herbicides	Rodenticides
Avitral	Ansar	Zinc Phosphide Bait
Amdro	Borocil	Pinalyl Bait
Baygon	Diquat	Diphacinone Bait
Chlordane	Maintain	Strychnine Bait
Cyanogas	Retard	
Cygon	Round-Up	
Dursban	Spike	
Dibrom (Naled)	Velpar	
Diazinon	2,4-D	
Ficam		
Lindane		
Malathion		
Naptha		
DDVP		
Sevin		
D-Phenothrin		

Source: Robins AFB Bioenvironmental Engineering Files

ANALYSIS OF SOIL SAMPLES COLLECTED FROM THE RADIOACTIVE
WASTE DISPOSAL AREA

Parameters	Units	Approximate Sample Location		
		100' from Site (Bottom of Hill)	Center of Site	20' from Site (Up Hill)
Gross Alpha	pCi/g	20	26	20
Gross Beta	pCi/g	17	27	24
Potassium 40	pCi/g	.17	1.82	1.24
Cesium 137	pCi/g	.084	1.59	.30
Uranium 238	pCi/g	1.07	1.03	1.87
Radium 226	pCi/g	.91	1.26	1.35
Thorium 232	pCi/g	1.45	1.34	2.00
Cobalt 60	pCi/g		.070	2.40

SOURCE: Base reports

APPENDIX E
SCOPE OF WORK

84 Jan 13

STAGED

Revision No. 1 to Description of Task

INSTALLATION RESTORATION PROGRAM

Phase IIB Field Evaluation

Robins AFB, Georgia *

I. Description of Work:

The purpose of this task is to determine if environmental contamination has resulted from waste disposal practices at Robins AFB GA; to provide estimates of the magnitude and extent of contamination, should contamination be found; to identify potential environmental consequences of migrating pollutants; to identify any additional investigations and their attendant costs necessary to properly evaluate the magnitude, extent and direction of movement of discovered contaminants.

The presurvey report (task order 5 of this contract, mailed under separate cover) and Phase I IRP report (mailed under separate cover), incorporated background and description of the sites for this task. To accomplish the survey effort, the contractor shall take the following steps:

A. General

1. Determine the areal extent of each zone by reviewing available aerial photos of the base, both historical and the most recent panchromatic and infrared. Only those aerial photos provided by Robins AFB shall be reviewed.

2. Locations where surface water samples are collected shall be marked with a permanent marker, and the location recorded on a project map for the zone.

3. All water samples collected shall be analyzed on site by the contractor for pH, temperature and specific conductance.

4. Sampling, maximum holding time and preservation of samples shall strictly comply with the following references: Examination of Water and Wastewater, 15th Ed. (1980), pp. 35-42; ASTM, Part 31, pp. 72-82, (1976), Method D-3370; and Method for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pp. xiii to xix (1979). Detection limits for sample analyses enumerated in Attachment I shall be strictly adhered to. The Air Force acknowledges that these sample detection limits may not be realistic if matrix interferences discussed in the above references are present.

5. All contractor installed wells shall be developed, to insure hydraulic interconnection between the well and the aquifer has been established. Water levels shall be measured, and locations surveyed and recorded on a project map and on a specific zone map. Groundwater monitoring wells shall as a minimum comply with Environmental Protection Agency guidelines and State of Georgia requirements for monitoring well installation. Only screw type joints shall be used. No glued fittings are permitted.

*Highlights of modification underscored

F33615-81-D-4007/001001

SHEET 1 OF 1No. LF 1-2ze 6" x 15' Slot 0.010"Size 2" x 10' Mat'1 SCH 40 PVCSize 2" x 7.5' Mat'1 SCH 40 PVCst W. D. ADAMSart 28 Oct 83 Finish 28 Oct 83cor WAR / LETCO

ROBT. BANKS

Location Coordinates 955, 040.6 N679, 328.7 EFilter Materials 20-30 SANDGrout Type SAND - CEMENTProtective Casing 6" x 5' BIPStatic Water Level 7.64 FTTop of Well Elevation 260.9 FT MSLDrill Type 6" HSA; CME-55

ch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	FILL. SD, VF-FA, QTZ, TR HVY MIN, ~10% SILT & CL, DRY, WHITE.	SP	N.A.
		4-5.5	SAND, VF-F, QTZ, TR HVY MIN, TR MICA, ANG, TR SILT & CL, DRY, WHITE.	SP	21
		9-10.5	SAND, VF-F, QTZ, TR HVY. MIN, TR MICA, ANG, ~5% SILT & CL, SATURATED, FAINT FUEL ODOR, WHITE.	SP	19
		14-15.5	14-15 : SAND, AS ABOVE. 15-15.5 : CLAY, ~10% VF-F SD (QTZ, MICA, & HVY MIN), SAT., LT. GRAY (10 YR 7/2).	SP CL	23 (N.A.)
	< 15'				

SHEET 1 OF 1

g No. LF 1-1
 Size 6" x 20' Slot 0.010"
 n Size 2" x 15' Mat'l SCH 40 PVC
 ig Size 2" x 7.5' Mat'l SCH 40 PVC
 glist W. D. ADAMS
 Start 28 OCT 83 Finish 28 OCT 83
 actor WAR/LET CO
 er ROBERT BANKS

Location Coordinates 955, 122.7 N
679, 234.9 E
 Filter Materials 20-30 SAND
 Grout Type NEAT CEMENT
 Protective Casing 6" x 5' B.I.P.
 Static Water Level 8.29 FT
 Top of Well Elevation 261.9 FT MSL
 Drill Type 6" HSA; CME-55

Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
	0	FILL. SD, VF-M, QTZ, GR HVY. MEN, TR GRAY., ~10% SLT & CL, LOOSE, DRY, WHITE.	SP	N.A.
	4-5.5	SAND, VF-M, QTZ, ~5% MICA, TR HVY. MEN., ~10% SLT & CL, DRY, NO ODOR, WHITE.	SP	21
< 4.0' PEINT SEAL	9-10.5	SAND, AS ABOVE EXCEPT SATURATED.	SP	15
	14-15.5	SAND, AS ABOVE EXCEPT UNID. ODOR. (STALE).	SP	22
	19-20.2	SAND, AS ABOVE.	SP	31
	20.2-20.5	CLAY, & TR SLT & VF SD, STIFF, SAT.	CL	N.A.
< 20'				

SHEET 2 OF 2Log No. FPT 2-2Size 6" x 85' Slot 0.010"In Size 2" x 20' Mat'l SCW 40 PVCLog Size 2" x 65' Mat'l SCW 40 PVCLogist W. D. ADAMSStart 4 DE 83 Finish _____Actor WAR / LETCOPer ROBT. BANKS

Location Coordinates _____

Filter Materials _____

Grout Type _____

Protective Casing _____

Static Water Level _____

Top of Well Elevation _____

Drill Type CME - 55; 12" HSA; 6" RCB.PIT CSG: 8" x 20' IRON

Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
	69-70.5	SAND, VF-M Q TZ, TR. D. O. TR SLT & CL, SAT, V. PALE X BRN (10 YR 8/4).	SP	
	74-75.5	SAND, VF-F, QTZ, TR. D. O., TR SLT & CL, SAT, WHITE (10 YR 8/2).	SP	
	79-80.5	SAND, AS ABOVE.	SP	
	84-85.5	SAND, AS ABOVE	SP	

SHEET 1 OF 2

Location Coordinates 943,780.3 N

683,718.3 E

Filter Materials KATIYE SAND.

Grout Type BEN. PEL. & SD. CEMENT.

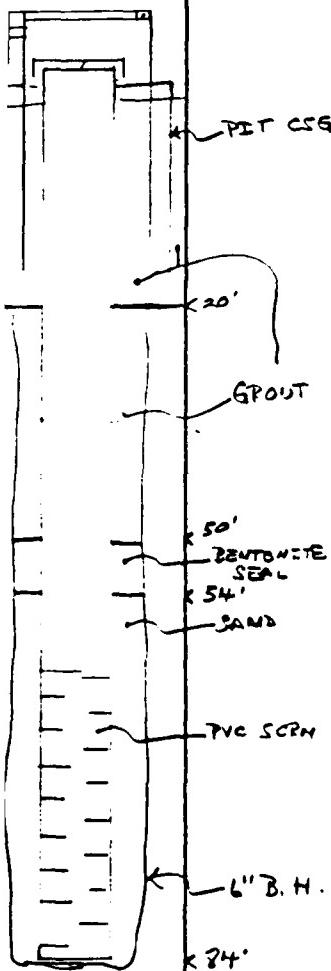
Protective Casing 5" X 5' IRON.

Static Water Level 32.17 FT

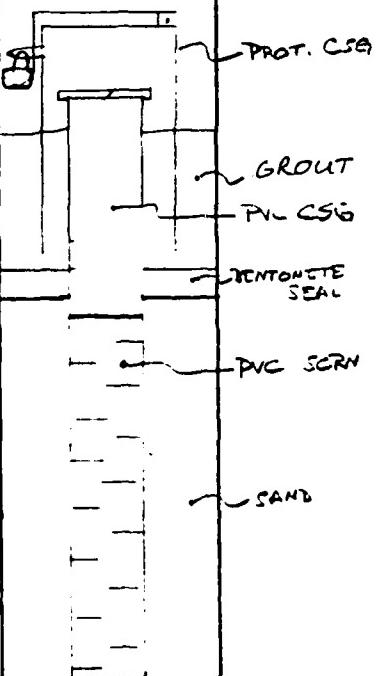
Top of Well Elevation 285.9 ft MSL

Drill Type CME-55:

PIT CSG : 8" X 20' IRON

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	<u>SAND</u> , CLAYEY. SD, VF-F, QTZ, TR MICA, ~ 30% SLT & CL, TR F. QTZ GRAYEL, MOIST, RED-YEL. (7.5Y 7/2).	SC	N.A.
		4-5.5	<u>SAND</u> , CLAYEY. SD, VF-F, QTZ, TR. D.O., ~ 20% SLT & CL, SAT, OLIVE (5Y 5/3).	SC	2
		9-10.5	<u>SAND</u> , CLAYEY. SD, VF-F, QTZ, TR. D.O., ~ 15% SLT & CL, SAT, SL. SOLVENT ODOR LT. GRAY (2.5Y 7/2).	SP-SC	16
		14-15.5	<u>CLAY</u> , SANDY. CL ~ 10-20%, VF-F QTZ, SD, SD DEC IN BOTTOM OF SAMPLE, ABUNDANT MICA, MOIST, SL. SOLVENT ODOR, GRAY (5Y 6/1).	CL	9
		19-20.5	<u>CLAY</u> , ~ TR VF SD & SLT, QTZ & MICA, MOIST, SOFT, WHITE ~ GRAY SPECKS.	CL	7
		24-25.5	<u>CLAY</u> , AS ABOVE.	CL	29
		29-30.5	<u>CLAY</u> , STIFF, DRY, WHITE.	CL	48
		34-35.5	<u>CLAY</u> , AS ABOVE.	CL	38
		39-40.5	<u>CLAY</u> , AS ABOVE.	CL	45
		44-45.5	<u>CLAY</u> , AS ABOVE.	CL	66
		49-50.5	<u>CLAY</u> , STIFF, DRY, LT GRAY (5Y 7/1).	CL	66
		52	<u>SAND</u> .		
		54-55.5	<u>SAND</u> , VF-F, QTZ, TR D.O., TR SLT & CL, SAT, WHITE.	SP	96
		59-60.5	<u>SAND</u> , VF-F, QTZ, TR D.O., TR MICA, ~ 10% SLT & CL, MOIST WK. RED (7.5R 5/2) & WHITE (10YR 8/1).	SP	132
		64-65.5	<u>SAND</u> , VF-F, QTZ, TR D.O., TR M QTZ SD, TR SLT & CL, SAT, WHITE.	SP	

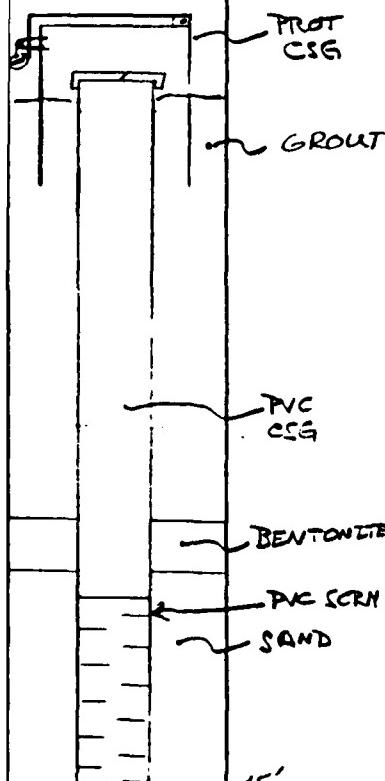
SHEET 1 OF 1Boring No. FPT 2-1Hole Size 6" x 20" Slot 0.010"Screen Size 2" x 15" Mat'l SCM 40 PVCCasing Size 2" x 7.5' Mat'l SCM 40 PVCGeologist W. D. ADAMSDate Start 25 OCT 83 Finish 25 OCT 83Contractor WAR / LETCODriller ROBT. BANKSLocation Coordinates 943,724.9 N683,713.9 EFilter Materials 20-30 SANDGrout Type NEAT CEMENTProtective Casing 6" x 5' BIPStatic Water Level 9.29 FTTop of Well Elevation 285.8 FT MSLDrill Type CMB-55; 6" HSA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
	0	0	<u>SAND, CLAYEY.</u> SD, VF-M, QTZ & SPAR, ~ 20%. SLT & CL, DRY, BR-YEL (10 YR 6/6).	SP-SC	NA
	4-5.5	5-6.5	<u>SAND, CLAYEY</u> , AS ABOVE EXCEPT CONTAMINATED BY <u>OILY WASTES</u> .	SP-SC	5
	9-10.5	9-10.5	<u>SAND, CLAYEY</u> . SD, VF-VC, QTZ, SPAR, & MICA, WELL-ROUNDED, ~ 20%. SLT & CL, SATURATED, <u>SOLVENT ODOR</u> , DK. GRAY (N 41).	SW-SC	12
	14-15.5	14-15.5	<u>CLAY, SANDY</u> , CL ~ 20%. SLT & VF SD, SOFT, MOIST, <u>METAL SHARD</u> , RED-YEL (7.5 YR 7/8).	CL-SC	5
	19-20.5	19-20.5	<u>CLAY</u> , ~ TR SLT & VF SD, DRY, STIFF, PROB. KAOLIN., PINK (7.5 YR 3/4).	CH	

SHEET 1 OF 1

Boring No. DDT-1
 Hole Size 6" x 45' Slot 0.010"
 Screen Size 2" x 10' Mat'l SCH 40 PVC
 Casing Size 2" x 37.5' Mat'l SCH 40 PVC
 Geologist W. D. ADAMS
 Date Start 27 OCT 83 Finish 27 OCT 83
 Contractor WAR/LETCO
 Driller ROBT. BANKS

Location Coordinates 949, 689.0 N
676, 076.1 E
 Filter Materials 20-30 SAND / NATIVE S.
 Grout Type NEAT CEMENT
 Protective Casing 6" x 5' IRON
 Static Water Level 43.98 FT
 Top of Well Elevation 308.2 FT MSL
 Drill Type CME-55; 6" HSA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	<u>SILT</u> , ~20% VF SD, DRY. LT BRN - GRAY (7 YR 6/2).	ML - SM	N.A.
		4-5.5	<u>CLAY</u> , <u>SANDY</u> , CL ~30%. VF - F QTZ SD & ILT, DRY, SOFT, LOW PLAS., RED RED-YEL (7.5 YR 6/3).	CL - SC	27
		9-10.5	<u>SAND</u> , <u>CLAYEY</u> . SD, VF-M, QTZ, ~5% HVY MIN, ~30% SLT & CL, DRY, RED-YEL (7.5 YR 6/3).	SC	33
		14-15.5	<u>CLAY</u> , ~10% VF SD (QTZ, HVY MIN, MICA), SOFT, LOW PLAS., DRY, RED-YEL (5 YR 6/3).	CL	25
		19-20.5	<u>SAND</u> , VF-C, QTZ, 10% HVY MIN, ~5% SLT & CL, DRY, PINK.	SW	9
		24-25.5	<u>SAND</u> , VF-C, QTZ, TR HVY MIN, ANG, TR SLT & CL, DRY, WHITE.	SW	34
		29-30.5	<u>SAND</u> , VF-F, QTZ, TR HVY. MIN, ANG, TR SLT & CL, DRY, WHITE.	SD	43
	45'	34-35.5	<u>SAND</u> , AS ABOVE.	SP	44
		39-40.5	<u>SAND</u> , <u>CLAYEY</u> . SD, VF-F, QTZ, TR HVY MIN, ~10% SLT & CL, SATURATED, WHITE	SC	27
		44-45.5	<u>SAND</u> , AS ABOVE, CLAY AT 45 FT.	CL	9

SHEET 1 OF 1

Boring No. HW-1

Hole Size 6" x 35' Slot 0.010"

Screen Size 2" x 15' Mat'l SCH 40 PVC

Casing Size 2" x 22.5' Mat'l SCH 40 PVC

Geologist W. D. ADAMS

Date Start 20 OCT 83 Finish 26 OCT 83

Contractor WAR/LET CO

Driller ROBERT BANKS

Location Coordinates 945, 043.8 N

684, 467.6 E

Filter Materials 20-30 SAND.

Grout Type NEAT CEMENT

Protective Casing 6" x 5' IRON

Static Water Level 27.94 FT

Top of Well Elevation 278.1 FT MSL

Drill Type 6" HSA

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	<u>SAND</u> , <u>CLAYEY</u> . VF-M SD, QTZ, ~20% SLT & CL, DRY, BRN (7.5 YR 5/6)	SC	N/A.
	5-6.5		<u>CLAY</u> , TR SLT & VF SD, DRY, STIFF, WHITE.	CH	30
	10-11.5		<u>CLAY</u> , AS ABOVE, PINKISH- WHITE (5 YR 3/2).	CH	39
	15-16.5		<u>SAND</u> , <u>CLAYEY</u> . VF-M, QTZ & SPAR, ANG SAND ~20% SLT & CL, DRY, PINK-WHITE (5 YR 3/2).	SC	32
	20-21.5		<u>SAND</u> , VF-M, QTZ & SPAR, TR HVV MEN, ANG, ~5% SLT & CL, DRY, PURPLE-WHITE (5 YR 3/2), STRINED & PURPLE	SP	42
	25-26.5		<u>SAND</u> , AS ABOVE.	SP	51.
	30-31.5		<u>SAND</u> , VF-M, QTZ & SPAR, TR MICA, ~10% SLT & CL, WET, YELLOW (10 YR 3/2).	SP	32
	35-36.5		<u>CLAY</u> , TR SLT & VF SD, V. STIFF, DRY, WHITE (5 YR 3/1).	CH	66

APPENDIX F
WELL LOGS

Required Sample Detection Limits

Chemical	Concentration
Total Organic Carbon (TOC)	1 mg/L
Nickel	100 µg/L
Copper	50 µg/L
Lead	20 µg/L
Zinc	50 µg/L
Chromium	50 µg/L
Cadmium	10 µg/L
Phenols	1 µg/L
Cyanide	10 µg/L
Total Organic Halogen (TOX)	5 µg/L
Polychlorinated Biphenyls (PCBs)	0.25 µg/L
Volatile Organic Compounds	*
Mercury	1 µg/L
Aldrin	0.02 µg/L
DDT Isomers	0.02 µg/L
Dieldrin	0.02 µg/L
Endrin	0.02 µg/L
Heptachlor	0.02 µg/L
Heptachlor Epoxide	0.02 µg/L
Lindane	0.01 µg/L
Methoxychlor	0.20 µg/L
Diazinon	0.02 µg/L
Malathion	0.10 µg/L
Parathion	0.02 µg/L
2,4-D	0.06 µg/L
2,4,5-T	0.06 µg/L
2,4,5-T Silvex	0.02 µg/L

*Detection limits for volatile aromatics and volatile halocarbons shall be as specified for compounds listed in EPA methods 601 and 602. For soil analysis report all values as µg solvent per gram of soil.

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VI. In addition to sequence numbers 1, 5 and 11 listed in Attachment 1 to the contract, and are applicable to all orders, the sequence number listed below is applicable to this order. Also shown are data applicable to this order.

<u>Seq Number</u>	<u>Block 10</u>	<u>Block 11</u>	<u>Block 12</u>	<u>Block 13</u>	<u>Block 14</u>
4	One/R	84Feb15	<u>84APR12</u>	<u>84JUL16</u>	*

*A minimum of two draft reports will be required. After incorporating Air Force comments concerning the first draft report, the contractor shall supply the USAF OEHL with a second draft report. The report will be forwarded to the applicable regulatory agencies for their comments. The contractor shall supply the USAF OEHL with 20 copies of each draft report, and 50 copies plus the original camera ready copy of the final report.

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to properly evaluate the magnitude, extent and direction of movement of discovered contaminants, specific recommendations, fully justified, shall be made for additional efforts required to properly evaluate contamination migration and included in a separately bound appendix to the draft final report (see G below).

3. Specific requirements for future groundwater and surface water monitoring must be identified.

F. Quality Assurance

The quality assurance specified in Section H, para (xxi) of the contract is applicable to this order.

G. Cost Estimates

Detailed cost estimates for all additional work recommended for those sites in need of proper determination or estimate of the magnitude, extent and direction of movement of discovered contaminants shall be provided, along with an estimate of the time required to accomplish the proposed effort. This information shall be provided in a separately bound appendix to the draft final report.

II. Site Location and Dates: Robins AFB GA
USAF Hospital/SGB
Dates to be established

III. Base Support: None

IV. Government Furnished Property: None

V. Government Points of Contact:

1. 1Lt David Gibson
USAF OEHL/ECQ
Brooks AFB TX 78235
(512) 536-3305
AV 240-3305
2. Col Harry Russell
HQ AFLC/SG
Wright-Patterson AFB OH 45433
(513) 257-6210
AV 787-6210
3. Lt Col Alan Perry
USAF Hospital/SGB
Robins AFB GA 31098
(912) 926-2248
AV 468-2248

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c. Analyze the six samples for total organic carbon, total organic halogen, cadmium, chromium, copper, lead, nickel, zinc, phenol, cyanide and volatile aromatic and volatile halocarbon compounds.

6. Zone 6. Hazardous Waste Burial Site

a. Install one groundwater monitoring well downgradient of the burial site. The well should penetrate at least 5 feet into the shallow aquifer.

b. Collect one groundwater sample from the contractor installed well.

c. Analyze water samples for DDT and its breakdown products, PCB and mercury.

7. Collect one sample from Robins AFB water supply wells 3, 6 and 8 and analyze the three samples for TOC, volatile aromatic and volatile halocarbons, cadmium, chromium, copper, lead, nickel, zinc, total cyanide and phenols.

Composite one sample by combining equal volumes of water from Robins AFB wells 3, 6 and 8 and analyze using GC techniques for the priority pollutant listing of 114 organic compounds.

C. Well Installation and Cleanup

Well installations shall be cleaned up following the completion of the well. Drill cuttings shall be removed and the general area cleaned. A maximum of 25 wells shall be installed in this investigation. Access to well sites will be provided by Robins AFB.

D. Data Review

Results of sampling and analysis shall be tabulated and incorporated on the monthly R&D Status Reports and forwarded to the USAF OEHL for review as soon as they become available as specified in Item VI below.

E. Report Preparation

1. A draft report delineating all findings of this field investigation shall be prepared and forwarded to the USAF OEHL as specified in Item VI below for Air Force review and comment. This report shall include a discussion of the regional hydrogeology, well logs of all project wells, data from water level surveys, water quality analysis results, available geohydrologic cross sections, groundwater surface and gradient vector maps, vertical and horizontal flow vectors and Laboratory quality assurance information. The report shall follow the USAF OEHL supplied format (mailed under separate cover).

2. Estimates shall be made of the magnitude, extent and direction of movement of contaminants discovered. Potential environmental consequences of discovered contamination must be identified. Where survey data are insufficient

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i. Collect one leachate sample from each of three locations adjacent to the landfill. Composite equal volumes of leachate into a single sample and analyze the composite sample utilizing GC techniques for volatile aromatics, volatile halocarbons and pesticides.

2. Zone 2. DDT Spill Site

a. Collect one surface soil sample from each of four locations and perform a total organochlorine pesticide scan on each sample using EPA Method 608.

b. Install one well to a depth of approximately ten feet below the water table. Collect one groundwater sample and perform a total organochlorine pesticide scan using EPA Method 8080.

3. Zone 3. Fire Protection Training Area No. 2

a. Install two groundwater monitoring wells each 75 feet deep.

b. Collect one water sample each from the two contractor installed wells and from existing Robins AFB wells W-11 and W-12 located within the zone.

c. Analyze water samples collected for total organic carbon (TOC), total organic halogen (TOX), lead and volatile aromatic and volatile halocarbon compounds. The contractor shall also perform analyses for cyanide and phenol on water samples collected from Robins wells W-11 and W-12.

4. Zone 4. Landfill No. 1 and JP-4 Spill Site

a. Install a maximum of five groundwater monitoring wells at least 5 feet into the shallow aquifer downgradient of the sites. Collect one water sample from each well.

b. Collect one leachate sample from each of the three seeps located downgradient of the sites.

c. Analyze groundwater and leachate samples for total organic carbon, total organic halogen, cadmium, chromium, copper, lead, nickel, zinc, phenol, cyanide and oil and grease.

d. Select two of the samples collected in a and b above, and analyze the two samples selected utilizing GC techniques for volatile aromatic and volatile halocarbon carbon compounds.

5. Zone 5. Landfill No. 2 and Fire Training Area No. 1

a. Install a maximum of three groundwater monitoring wells at least 5 feet into the aquifer downgradient of the combined sites.

b. Collect a maximum of three surface water samples from either streams adjacent to the sites or from leachate seeps at the landfill and a maximum of three groundwater samples, one from each well.

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6. Field data collected for each zone shall be plotted and mapped. The nature, magnitude and potential for contaminant flow within each zone to receiving streams and groundwaters shall be estimated.

7. A maximum of 1290 feet of well length shall be installed under this task.

8. The contractor shall purchase a submersible pump for use in well development and sample collection. At the conclusion of the study the pump shall be turned over to the USAF OEHL.

B. In addition to items delineated in A above, conduct the following specific actions at sites identified on Robins AFB:

1. Zone 1. Landfill No. 4 and Sludge Lagoon

a. Install four wells, two each at two separate locations between the sludge lagoon and the stream north of the lagoon. One well, 25 feet deep and one well, 50 feet deep shall be installed at each location.

b. Install one groundwater monitoring well upgradient of the landfill. The well shall be installed to a depth of 100 feet and screened over the entire saturated thickness. Install a total of six wells downgradient of the landfill perimeter. Wells 30, 65 and 100 feet deep shall be installed at two separate locations. The contractor shall also install two wells at one location adjacent to Hannah Road. These wells shall be 50 and 100 feet deep.

c. Collect one water sample from each installed well.

d. Determine the physical condition and suitability for sampling of the eight existing wells located downgradient of this landfill. Select two wells for sampling. Collect one water sample from each selected well.

e. Select two existing downgradient monitoring wells along Hannah Road. Collect one water sample from each well.

f. Analyze water samples collected for total organic carbon (TOC), nickel, copper, lead, zinc, chromium, cadmium, phenol, cyanide and total organic halogen.

g. Select six of the collected samples to be analyzed for volatile aromatics and volatile halocarbons.

h. Collect a maximum of four surface water and a maximum of three sediment samples from locations downgradient of the landfill. Analyze the surface water samples for the parameters listed in f above. Analyze the sediment samples for nickel, copper, lead, zinc, chromium, cadmium, phenolics, cyanide, and loss of ignition at 550°C. Select one sediment sample and one surface water sample and analyze each water and sediment sample utilizing GC techniques for volatile aromatics, volatile halocarbons and pesticides.

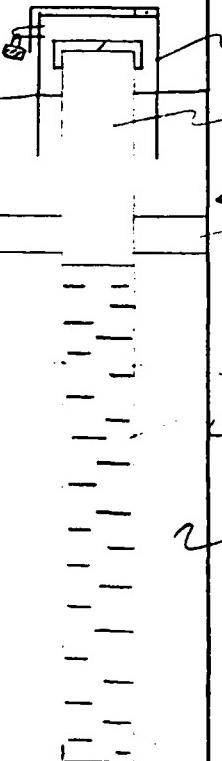
F33615-81-N-4007/001001

SHEET 1 OF 1Boring No. LF 1-3Hole Size 6" x 20' Slot 0.010"Screen Size 2" x 15' Mat'1 SCH 40 PVCCasing Size 2" x 7.5' Mat'1 SCH 40 PVCGeologist W.D. ADAMSDate Start 28 Oct 83 Finish 28 Oct 83Contractor WAR/LETCODriller ROBT. BANKSLocation Coordinates 954, 944, 2N679, 440, 3EFilter Materials 20-30 SANDGrout Type SAND-CEMENTProtective Casing 5" x 5' IRONStatic Water Level 8.71 FTTop of Well Elevation 260.5 FT MSLDrill Type 6" HSA; CME -55

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	<u>SAND</u> , VF-F, QTZ, TR HVY MICA, ~5% SLT & CL, DRY, WHITE.	SP	NA
	4-5.5		<u>SAND</u> , VF-F, QTZ, TR MICA, TR HVY MICA, ~10% SLT & CL, DRY, LT.GRAY (10 YR 7/2').	SP	23
	9-10.5		<u>SAND</u> , AS ABOVE EXCEPT SATURATED SL. FUEL ODOR.	SP	17
	14-15.5		<u>SAND</u> , AS ABOVE EXCEPT NO FUEL ODOR.	SP	28
	19-20.5		<u>SAND</u> , AS ABOVE.	SP	

SHEET 1 OF 1

Boring No. LF 1-4
 Hole Size 6" x 15' Slot 0.010"
 Screen Size 2" x 10' Mat'1 SCH 40 PVC
 Casing Size 2" x 7.5' Mat'1 SCH 40 PVC
 Geologist W.D. ADAMS
 Date Start 26 OCT 83 Finish 26 OCT 83
 Contractor WAR/LETCO
 Driller ROBT. BANKS
 Location Coordinates 954, 160.5 N
679, 462.5 E
 Filter Materials 20-30 SAND
 Grout Type SAND - CEMENT
 Protective Casing 6" x 5' IRON
 Static Water Level 2.29 FT
 Top of Well Elevation 253.9 FT MSL
 Drill Type 6" HSA; CME-55

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	<u>SAND</u> , VF-F, QTZ, TR Hvy Mn, TR SLT & CL, MOIST, PALE BRN (10 YR 6/3).	SP	N.A.
	4-5.5	.	<u>SILT</u> , <u>ORGANIC</u> , ~ 10% NON-DECAYED PLNT MATL, LENSES OF VF-F QTZ SD, PLASTIC, MOIST, BLACK (N 4).	OL	3
	< 5.0'	9-10.5	<u>CLAY</u> , <u>SANDY</u> , ~ 20% VF-M SD, SATURATED, SOFT, ∞ LOG OR ROOT, LT. GRAY (7.5 YR 7/L).	SC	5
	12-14(?)	.	<u>SAND</u> , SATURATED.	SP	N.A.
	14-15.5	.	<u>SILT</u> , <u>ORGANIC</u> , ~ 10% VF QTZ SD, MOIST, SOFT, MOD. PLASTIC, DK. GRAY-BRN (10 YR 4/2).	OL	
	15.5'				

SHEET 1 OF 1

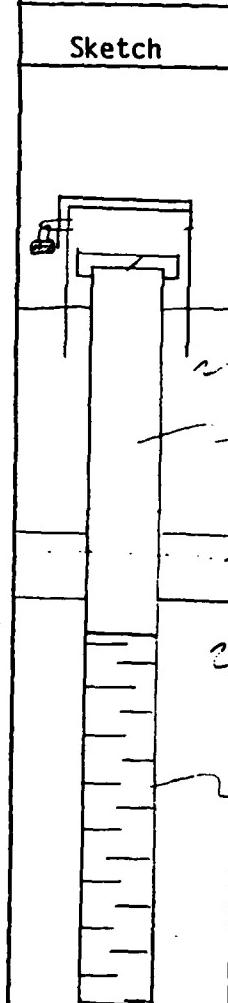
Boring No. LF 1-5
 Hole Size 6" x 16.5' Slot 0.010"
 Screen Size 2" x 10' Mat'1 Sch 40 PVC
 Casing Size 2" x 7.5' Mat'1 Sch 40 PVC
 Geologist W.D. ADAMS
 Date Start 26 OCT 83 Finish 26 OCT 83
 Contractor WAR / LETCO
 Driller ROBT. BANKS

Location Coordinates 953, 943.0 N679, 601.1 EFilter Materials 20-30 sandGrout Type SAND-CEMENT.Protective Casing 6" x 5' IRON.Static Water Level 2.42 FTTop of Well Elevation 252.5 FT MSLDrill Type 6" USA; CME-55

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	<u>SAND</u> , VF-F, QTZ, TR SLT & CL, TR GRAVEL, TR O.M., DRY, DK GRAY-BRN (10 YR 4/2)	SP	M.A.
		4-5.5	<u>PEAT</u> , ~30% PARTIALLY DECOMPOSED PLNT. MATL., ~65%+ COLLOIDAL O.M., TR SLT & Y.F. SD, SATURATED, BLACK (N 2/).	PT	4
		9-10.5	<u>MUCK SILTY</u> , ~TR VF-F SD, QTZ & MICA, SATURATED, Y. SOFT, DK. GRAY-BRN (10 YR 4/2).	OM	0
		14-15.5	<u>SAND</u> , VF-F, QTZ, ~5% HVT MIN, ~5% MICA, SAT, WHITE (N 3/). CHANGING TO MED QTZ SD, ~5% HVT MIN, ~5% MICA, SAT, TR SLT & CL, RED-YEL (7.5 YR 6/8).	SP	14
		19-20.5	<u>SAND</u> , VF-M, QTZ, ~5% HVT MIN, TR SLT & CL, SATURATED, YELLOW (10 YR 3/7).	SP	15

Boring No. LF 2-1Hole Size 6" x 30' Slot 0.010"Screen Size 2" x 15' Mat'1 SCH 40 PVCCasing Size 2" x 15.5' Mat'1 SCH 40 PVCGeologist W. D. ADAMSDate Start 30 Oct 83 Finish 30 Oct 83Contractor WAR/LET CODriller ROBT. BANKS

SHEET 1 OF 1
 Location Coordinates 954, 237.2 N
680, 888.7 E
 Filter Materials NATIVE SD / 20-30 SAND
 Grout Type SD - CEMENT
 Protective Casing 5" x 2.5' B.I.P.
 Static Water Level 9.46 FT
 Top of Well Elevation 257.0 FT MSL
 Drill Type 6" HSA; CME-55

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
	0		<u>SAND</u> , SILTY. SD, VF, QT2, TR HVY MN, ~30% SLT, TR CL, DRY, BRN (10 YR 5/2), TR GRAVEL. FILL.	SM	N/A.
	4-5.5		4-5: AS ABOVE. 5-5.5: AS ABOVE, EXCEPT NO GRAVEL, MOIST, YELLOW (10 YR 7/7).	SM	11
	9-10.5		<u>SAND</u> , CLAYEY. SD, VF-M, QT2, ~10% HVY MN, ~20% SLT & CL, MOIST, TR C QT2 SD, PALE YELLOW (2.5 Y 3/4).	SC	10
	14-15.5		<u>CLAY</u> ~ TR VF SD & SLT, STIFF, MOIST, GREEN - GRAY (5 B 6/L).	CL	6
	19-20.5		<u>CLAY</u> , TR VF SD (QT2, HVY MN, & MICA) & SLT, STIFF, MOIST, LT GRAY (2.5 Y 4/1).	CL	10
	24-25.5		<u>SAND</u> , VF-F, QT2, TR HVY MN, TR CRS QT2 SD, TR SLT & CL, SATURATED, YELLOW (10 YR 5/7).	SP	12
	29-30.5		<u>SAND</u> , VF-F, QT2, TR HVY MN & MICA, TR SLT & CL, SAT., PINK (5 YR 8/3).	SP	21

SHEET 1 OF 1Boring No. LF 2-2Hole Size 6" x 30' Slot 0.010"Screen Size 2" x 15' Mat'l SEN 40 PVCCasing Size 2" x 16' Mat'l SEN 40 PVCGeologist W. D. AdamsDate Start 29 Oct 83 Finish 29 Oct 83Contractor WAR / LETCODriller ROBT. BANKSLocation Coordinates 954, 160.7 N680, 522.9 EFilter Materials NATOVE SD & 20-30 SANDGrout Type SAND-CEMENTProtective Casing 5" x 2.5' BIPStatic Water Level 8.84 FTTop of Well Elevation 257.1 FT MSLDrill Type 6" HSA ; CME - 55

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	<u>SAND</u> , SILTY (FILL). SD, VF, QTZ, & SLT, DRY, LT BRN - GRAY (10 YR 6/2).	SM	N.A.
		4-5.5	<u>SAND</u> , CLAYEY. SD, VF-F, QTZ, TR HVY MIN, TR MICA, TR M QTZ SD, DRY, RED-YELLOW (5 YR 7/8, WET).	SC	19
		9-10.5	<u>CLAY</u> , SANDY. CL = ~ 20% VP-F QTZ SD, SL STIFF, SATURATED GR-BRN (2.5 Y 5/2). PEAT (10.5').	CL	2
		14-15.5	14-14.2: PEAT. 14.2-15.5: CLAY, ~ 5% SLT & VF SD, SOFT, PLASTIC, SATURATED, GRAY (N 6/1).	PT	N.A.
		19-20.5	19-19.5: CLAY, AS ABOVE. 19.5-20.5: CLAY, SANDY. CL = ~ 20%. SLT & VF SD (QTZ, HVY MIN, & MICA), SOFT, SL. PLAS, SATURATED, YELLOW (10 YR 7/8) & WHITE (N 8/1).	CL	4
	30.0'	24-25.5	<u>SAND</u> , VF-F, QTZ, TR HVY MIN, SATURATED, YELLOW (2.5 Y 8/6).	SP	8
		29-30.5	<u>SAND</u> , AS ABOVE.	SP	12

SHEET 1 OF 1Boring No. LF 2-3Hole Size 6" x 30' Slot 0.010"Screen Size 2" x 20' Mat'l 1 SCH 40 PVCCasing Size 2" x 12.5' Mat'l 1 SCH 40 PVCGeologist W. D. ADAMSDate Start 28 OCT 83 Finish 29 OCT 83Contractor WAR/LETCODriller ROB. BANKSLocation Coordinates 954, 251.3 N679, 929.1 EFilter Materials NATIVE SANDGrout Type SAND-CEMENTProtective Casing 5" x 5' B.I.P.Static Water Level 7.71 FTTop of Well Elevation 257.3 FT MSLDrill Type 6" HSA; CME-55

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	FILL, ROCK FRAGS, SD, VF-F. FILL, AS ABOVE.	N.A.	N.A.
		4-5.5		N.A.	10
		9-10.5		PT	2
		14-15.5	PEAT, SATURATED, V. DK-GRAY BRN (10 YR 3/2).	PT SW-Q	9
		19-20.5	14-14.5: PEAT, AS ABOVE. 14.5-15.5: SAND, GRAVELLY, SD, VF-VC, QTZ, SATURATED, ~30% GRAVEL, GRAY (5 YR 6/1).	SW	13
		24-25.5	SAND, VF-VC, QTZ, ANG, TR SLT & CL, TR GRAN., SATURATED, V. PALE BRN (10 YR 3/4).	SP	15
		30	SAND, VF-M, QTZ, ANG, TR HVP MIN, TR C. QTZ SD, TR SLT & CL, SATURATED, V. PALE BRN (10 YR 3/4). SAND, AS ABOVE. (WASHED SAMPLE).	SP	N.A.
	30'				

SHEET 1 OF 2

Location Coordinates 953, 149.1 N

682, 405.9 E

Filter Materials ~~as~~ NATIVE SAND.

Grout Type BEU.PEL (3') & SD.-CEM (80')

Protective Casing 5" x 2.5' B.I.P.

Static Water Level 2.34 FT

Top of Well Elevation 249.4 FT MSL

Drill Type CME-55; 6" RCB.

Boring No. LF 4-1
 Hole Size 6" x 100' Slot 0.010"
 Screen Size 2" x 15' Mat'l SCS 10 S.S.
 Casing Size 2" x 85' Mat'l S.S. (50') PVC (80')
 Geologist W.D. ADAMS
 Date Start 12 Nov 83 Finish 13 Nov 83
 Contractor WAR/LET CO
 Driller ROBT. BANKS

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
	0	4-5.5	<u>FILL</u> . 4-5: <u>SAND</u> , VF-C, QTZ, ~5% D.O., ANG, ~5% SLT & CL, V. PALE BRN (10 YR 7/3).	S.W.	N.A. 4
	9-10.5		5-5.5: <u>SAND</u> , <u>CLAYEY</u> . SD, VF-M, QTZ, TR D.O., PRED. VF-F, ~30% SLT & CL, MOIST, GRAY.	SC	
	14-15.5		<u>CLAY</u> , ~10% SLT & VF SD, QTZ & MECA, STIFF, SAT., LT. BL. GRAY (5B 7/1) & RED-YEL. (7.5 YR 7/8).	CL	7
	~18				
	19-20.5		<u>SAND</u> , VF-M, QTZ, ~10% D.O., ANG, ~1% M SD, ~5% SLT & CL, SAT., STRONG BRN (7.5 YR 5/6).	SP	15
	24-25.5		<u>SAND</u> , VF-C, ~10% GRAVEL, CHANNEL TO VF-M SD, QTZ, ~5% D.O., ~5% SLT & CL, SAT, V. PALE BRN (10 YR 8/4).	SP-SW	21
< 70'					
	29-30.5		<u>SAND</u> , VF-F, QTZ, TR D.O., ANG, TR SCT & CL, SAT, WHITE.	SP	36
	34-35.5		<u>SAND</u> , VF-F, TR MED, QTZ, TR D.O., TR SCT & CL, SAT., PALE YELLOW (2.5 Y 8/4).	SP	32
	39-40.5		<u>SAND</u> , VF-F, QTZ, ANG, ~5% SLT & CL, SAT, TR D.O., RED-YEL. (7.5 YR 7/8).	SP	20
	44-45.5		<u>SAND</u> , VF-F, QTZ, TR D.O., ANG, TR SLT & CL, SAT., V. PALE BRN (10 YR 8/4).	SP	88
100'	49-50.5		<u>SAND</u> , AS ABOVE EXCEPT PINK (7.5 YR 8/4) & (5 YR 8/3).	SP	89
	54-55.5		<u>SAND</u> , AS ABOVE.	SP	30
	59-60.5		<u>SAND</u> , <u>CLAYEY</u> . SD, VF-F, QTZ, TR D.O., ~20% SLT & CL, SAT., TR MECA, V. PALE BRN & YELLOW, 1/2 STIFF OF PALE RED.	SC	

Boring No. LF 4-1Hole Size SlotScreen Size Mat'lCasing Size Mat'lGeologist W. D. ADAMSDate Start 12 Nov 83 Finish 13 Nov 83Contractor W.A.R. / LETCODriller ROBT. BANKS.

Location Coordinates _____

Filter Materials _____

Grout Type _____

Protective Casing _____

Static Water Level _____

Top of Well Elevation _____

Drill Type _____

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
	64-65.5	<u>SAND</u> , AS ABOVE EXCEPT PINK. - WHITE (5 YR 3/2).	SC	33	
	69-70.5	<u>CLAY, SANDY</u> . CL. E ~30%. VF-F SD (QTZ, TR DO, LTR MICA), STIFF, SAT., RD. - YELLOW (7.5 YR 7/8).	CL	19	
	74-75.5	<u>CLAY, SANDY</u> . AS ABOVE EXCEPT RED-YELLOW (7.5 YR 7/8) & STREAKS OF DUSKY RED (7.5 YR 3/4). CHANGES AT BOTTOM TO <u>CLAY</u> , E TR SLT & VF SD (QTZ, MICA), STIFF, MOIST, GRAY (N6/1) & YELLOW (10 YR 7/8).	CL	20	
	79-80.5	<u>CLAY</u> , E TR SLT & VF SD, STIFF, PLASTIC, MOIST, RED-YEL. (7.5 YR 7/8) & PINK-GRAY (7.5 YR 7/2). SAND CONTENT INC. TO ~20% AT TIP.	CL	12	
	84-85.5	<u>SAND</u> , VF-F, QTZ, ROUND, TR SLT & CL, SAT, YEL. (10 YR 7/8).	SP	52	
	89-90.5	<u>SAND</u> , VF-F, QTZ, TR DO, ANG, TR SLT & CL, SAT, V. PALE BRN. (10 YR 3/4).	SP	104	
	94-95.5	<u>SAND</u> , AS ABOVE, RED-YEL (7.5 YR 7/8).	SP	72	
	100-101.5	<u>SAND</u> , AS ABOVE EXCEPT TR MED SD.	SP	52	

ing No. LF 4-2

le Size 6" x 50' Slot 0.010"

reen Size 2" x 15' Mat'1 SCH 10 S.S.

sing Size 2" x 37.5' Mat'1 SCH 10 P.V.C., SCH 40

olongist W.D. ADAMS

te Start 14 Nov 83 Finish 14 Nov 83

ntractor WAR/LETCO

iller ROBERT BANKS

SHEET 1 OF 1

Location Coordinates 953, 135.7 N

682, 410.8 E

Filter Materials 2G-30 SAND

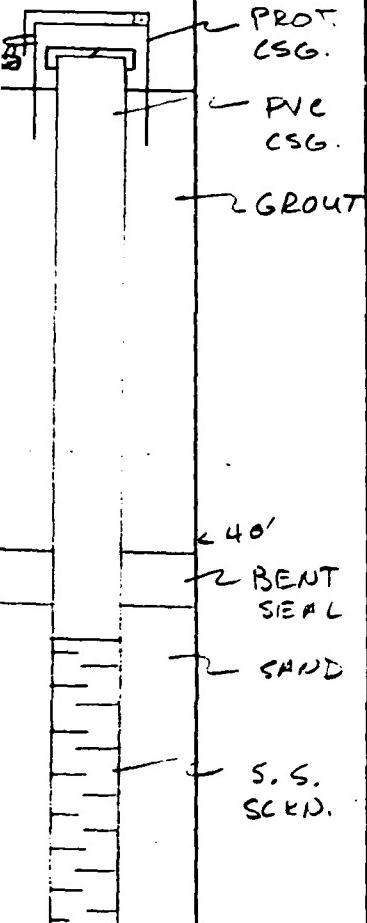
Grout Type SAND-CEMENT

Protective Casing 5" x 2.5' IRON

Static Water Level 4.67 FT

Top of Well Elevation 249.3 DO MSL

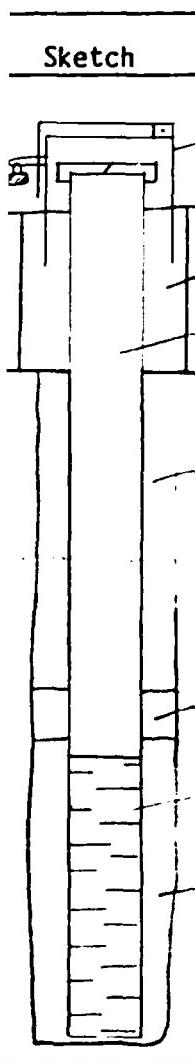
Drill Type CME-55; 6" RCD

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
	50'		SEE LOG FOR LF 4-1.		

SHEET 1 OF 1

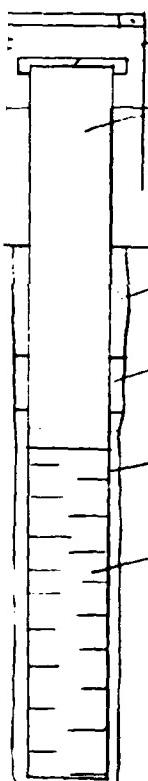
oring No. LF 4-3
ole Size 6" x 50' Slot 0.010"
creen Size 2" x 15' Mat'l SCH 10 SS
asing Size 2" x 37.5' Mat'l S.S. + SCH 40 PVC
eologist W.D. ADAMS
ate Start 16 Nov 83 Finish 17 Nov 83
ontractor WAR/LETCO
riller ROBT. BANKS

Location Coordinates 953, 773.9 N
680, 051.9'E
Filter Materials 20-30 SAND
Grout Type SAND-CEMENT
Protective Casing 5" x 5' IRON
Static Water Level 8.04 FT
Top of Well Elevation 257.4 FT MSL
Drill Type CME-55; 6" RCB
Per Casting 8" x 10' IRON.

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	<u>SAND, CLAYEY, SD, VF-F, TR MED, QTZ, TR. D.O., ANG, TR SLT & CL, MOIST, STRONG BRN (7.5 YR 5/6).</u>	SC	N.A.
	4-5.5		<u>CLAY, T ~ 30%. SLT & VF SD, SOFT, MOIST, "SOLVENT" ODOR, OLIVE GRAY (5 Y 5/2).</u>	SC-CL	3
	9-10.5		<u>9-9.5: CLAY, AS ABOVE. 9.5-10.5: PEAT WOODY, MOIST, SL. "SOLVENT" ODOR, BLACK.</u>	CL-PE PT	2
	14-15.5		<u>CLAY, T TR SLT & VF SD, ~ 25%. TLNT FIBERS, SOFT, SAT, V. DIR. GRAY. CHANGES AT ~ 15.4 TO: SAND, CLAYEY & GRAVELLY, SD, VP-VC, QTZ, ~ 30%. SLT & CL, ~ 10% GRAVEL, QTZ, ANG, SOFT, SAT, GRAY.</u>	CL-CL	6
	19-20.5		<u>SAND, VP-VC, QTZ, TR D.O., ANG, ~ 5% QTZ GRAVEL IN UPPER PART, ~ 10% SLT & CL, SAT, V. PALE BRN (10 YR 8/3).</u>	SP	
	24-25.5		<u>SAND, VF-F, QTZ, TR D.O., ANG TO SUB-ROUND, TR MED QTZ SD, TR SLT & CL, SAT, YEL. (10 YR 7/6).</u>	SP	9
	29-30.5		<u>SAND, VF-F, QTZ, TR D.O., TR MICA, ~ 10% SLT & CL, SAT, WHITE.</u>	SP	22
	34-35.5		<u>SAND, VF-F, QTZ, TR D.O., TR. MICA, ~ 5-10% SLT & CL (INCREASES AT BOTTOM), SAT, WHITE.</u>	SP	38
	39-40.5		<u>SAND, CLAYEY, SD, VF-F, QTZ, TR D.O., ANG, ~ 20% SLT & CL, SAT, YEL. (10 YR 7/8) & YEL-RED (5 YR 8/8).</u>	SC	
	44-45.5		<u>SAND, VF-F, QTZ, TR D.O., TR. MICA, ANG, ~ 5% SLT & CL, MOIST, WHITE.</u>	SP	23
	49-50.5		<u>SAND, AS ABOVE EXCEPT BRN.</u>	SP	

g No. LF 4-4
 Size 6" x 25' Slot 0.010"
 n Size 2" x 10' Mat'l SCH 40 S.S.
 iq Size 2" x 17.5' Mat'l SCH 40 S.S. (5')
SCH 40 PVC
 igist W.D. ADAMS
 Start 17 Nov 83 Finish 17 Nov 83
 ractor WAR/LETCO
 ler ROBT. BANKS

SHEET 1 OF 1
 Location Coordinates 953, 780.7 N
680, 057.7 E
 Filter Materials 20-30 SAND
 Grout Type SAND-CEMENT
 Protective Casing 5" x 5' IRON
 Static Water Level 8.27 FT
 Top of Well Elevation 257.5 FT MSL
 Drill Type CME - 55; 6" RCB.
 PIT CASING: 8" x 10' IRON

Borehole	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
 PROT. CSG. PVC CSG - GROUT GROUT < 10' BENT SEAL SAND S.S. SCRN. 25.0'			SEE LITH. LOG FOR LF 4-3.		

SHEET 1 OF 1

ng No. LF 4-5

Size 6" x 50' Slot 0.010"

Ten Size 2" x 15' Mat'l EN1055.

ing Size 2" x 35' Mat'l S.S. (5') + PVC

ogist W.D. ADAMS

Start 16 Nov 83 Finish 18 Nov 83

ractor WAR/LET Co

iller H. CARNLEY.

Location Coordinates 953, 756.6 N

680, 191.7 E

Filter Materials 20-30 SAND

Grout Type BEN. PEL. + SD. CEM (2:1)

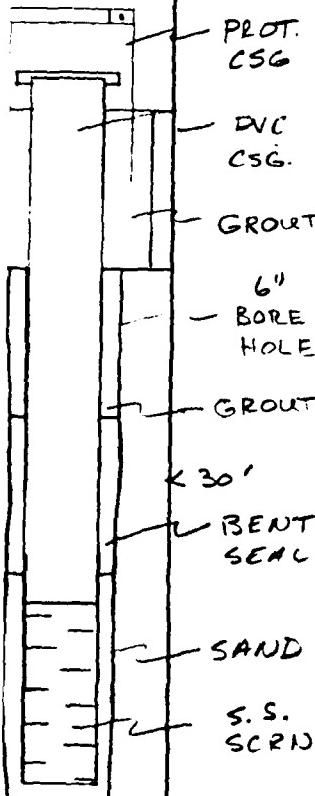
Protective Casing 5" x 5' IRON

Static Water Level 7.04 FT

Top of Well Elevation 256.2 FT MSL

Drill Type FAILING 1500; 6" DRAG BIT.

PIT CASING 8" x 7' IRON

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0	SAND, CLAYEY (FILL). SD, VF-F, QTZ, TR. D.O., ANG, ~20%. SLT & CL, MOIST, ST. BRN (7.5 YRS 1/2).	SC	N.A.
		4-5.5	SAND, GRAVELLY & CLAYEY. SD, VF-M, QTZ, ~5%. ANG, QTZ GRAVEL, ~30%. SLT & CL, SAT., OLIVE GRAY (5 YR 5/2).	SC	14
		5.5-7	CLAY, SANDY. CL & ~20%. VF-M, ANG (QTZ SD, SOFT, SAT, SOLVENT ODOR (FAINT), OLIVE GRAY (5 YR 5/2)).	CL-SC	3 (ODOR)
	6"	7-8.5	PEAT, WOODY, MOIST, V.DK. BROWN.	PT	2
	9-10.5	9-10.5	PEAT, AS ABOVE.	PT	2
	14-15.5	14-15.5	SAND, GRAVELLY & CLAYEY. SD, VF-YC, QTZ, TR D.O., ~10%. MED QTZ GRAVEL, ~10%. SLT & CL, SAT, LT. BRN. GRAY (2.5 YR 6/2).	SW-SG	32 (ODOR)
	< 30'	19-20.5	SAND, VF-F, QTZ, TR. D.O., ANG, TR SLT & CL, SAT, YELLOW (10 YR 7/8).	SP	18
	24-25.5	24-25.5	SAND, AS ABOVE.	SP	13
	29-30.5	29-30.5	SAND, CLAYEY. SD, VF-F, TR. M, QTZ, TR D.O., TR MICA, ANG, ~20%. SLT & CL, SAT, PINK. WHITE (5 YR 3/2).	SC	21
	34-35.5	34-35.5	SAND, VF-F, QTZ, TR D.O., TR MICA, ANG, ~10%-20%. SLT & CL, PINK. WHITE (5 YR 3/2) AND RED. YEL. (7.5 YR 7/8).	SC-SP	56
50'	39-40.5	39-40.5	SAND, AS ABOVE.	SC-SP	36
	44-45.5	44-45.5	SAND, VF-F, QTZ, TR D.O., ANG, TR SLT & CL, SAT, PINK. WHITE (5 YR 8/2) & RED. YEL. (7.5 YR 7/8).	SP	46
	49-50.5	49-50.5	SAND, VF-F, QTZ, ~5%. MICA, TR D.O., ~10%. SLT & CL, SAT, YEL. BRN. (10 YR 5/6) CHANGES AT TOP TO: CLAY, ~20%. SAND (QTZ & MICA) SOFT, YELLOW (10 YR 8/8) AND RED (10 YR 5/6).	CL	

No. LF 4-6

ze 6" x 25' Slot 0.010"

Size 2" x 10' Mat'l SCH 10 S.S.

Size 2" x 17.5' Mat'l 5" SCH 10 S.C.

ist W.D. ADAMS

tart 3 DE 83 Finish 3 DE 83

ctor WAR/LETCO

r ROBT. BANKS

SHEET 1 OF 1

Location Coordinates 953,768.2 N

680,186.6 E

Filter Materials 20-30 SAND

Grout Type SAND-CEMENT

Protective Casing 5" x 5' IRON.

Static Water Level 7.46 FT

Top of Well Elevation 256.5 FT MSL

Drill Type CMZ-55; 6" RCB

PIT CSG 8" x 7' IRON

tch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
			SEE LITH LOG FOR LF 4-5		

PROT CSG.
PVC CSG.
GROUT
< 10'
BORE HOLE
GROUT
BENT. SEAL
SAND
S.S. SCBN
25'

SHEET 1 OF 2

g No. LF 4-7
 Size 6" x 100' Slot 0.010"
 n Size 2" x 15' Mat'l SCH 105.5.
 g Size 2" x 87.5' Mat'l SCH 40 PVC
 glist W. D. Adams
 Start 15 Nov 83 Finish 2 DE 83
 actor WAR / LETCO
 er H. CARNLEY

Location Coordinates 953, 246.4 N
 681, 092.3 E
 Filter Materials 20-30 SAND
 Grout Type SD - CEMENT
 Protective Casing 5" x 5' IRON
 Static Water Level 3.42 FT
 Top of Well Elevation 251.7 FT MSL
 Drill Type FAILING 1500; 6" RCB

PIT CSG: 8" x 15' IRON

Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
0-4	0-4	FILL. CLAYEY SAND.	SC-CL	2
4-5.5	4-5.5	PEAT, ~90% COLLOIDAL, ~10% PLANT FIBERS, SAT., BROWN.	PT	2
9-10.5	9-10.5	9-10: PEAT, AS ABOVE.	PT	2
10-10.5	10-10.5	10-10.5: CLAY & TR SLT & VF SAND, SOFT, SAT., LT. GRAY (10 YR 6/1).	CL	
14-15.5	14-15.5	CLAY, AS ABOVE.	CL	5
17-20.5	17-20.5	SAND, VF-YC, QTZ, ANG, ~10% GRAVEL, TR SLT & CL, SAT, V. PALE BRN (10 YR 7/4).	SW-SP	12
24-25.5	24-25.5	SAND, CLAYEY. SD, VF-M, TR D.O., TR MICA, SAT, WHITE (10 YR 8/1)	SC	44
29-30.5	29-30.5	SAND, CLAYEY. AS ABOVE EXCEPT WHITE & PALE RED (10 R 6/4)	SC	29
34-35.5	34-35.5	CLAY, TR SLT & VF SD, V. STF, SAT., LT GRAY (2.5 Y NM/1)	CL	18
39-40.5	39-40.5	SAND, VF-M, QTZ, TR D.O., ~5% SLT & CL, SAT, PALE RED (10 R 6/4).	SP	45
44-45.5	44-45.5	SAND, AS ABOVE.	SP	44
49-50.5	49-50.5	SAND, AS ABOVE, SOLVENT ODOR	SP	97
54-55.5	54-55.5	SAND, AS ABOVE.	SP	79
59-60.5	59-60.5	SAND, AS ABOVE, GRAY.	SP	77
64-65.5	64-65.5	SAND, AS ABOVE, WHITE.	SP	17
69-70.5	69-70.5	SAND, CLAYEY	SC	10
74-75.5	74-75.5	SAND.	SP	78
79-80.5	79-80.5	SAND.	SP	50
84-85.5	84-85.5	SAND.	SP	50
89-90.5	89-90.5	SAND, CLAYEY.	SC	59

After contacting appropriate emergency services, or in nonemergency incidents, the USAF project contact should be notified of the incident or accident so that it can be dealt with according to base policies and procedures.

personal protection, the EPA Safety Manual for Hazardous Waste Site Investigations will be referred to for guidance.

G-6.0 SAFETY PROCEDURES

Hard hats and eye protection will be worn when appropriate, as directed by the project field supervisor. Protective clothing (boots, gloves, and coveralls) will be worn at all times while working on-site.

Coveralls will be changed a minimum of once daily.

The project field supervisor will consult with the base environmental coordinator or other responsible contact regarding site-specific hazards prior to entering sites. Special procedures for entering and working at particular sites will be clarified and conveyed to all field personnel. Examples of areas requiring strict procedures are active runways or taxiways, fuel handling or storage areas, and secure areas.

Prior to any drilling or digging on the sites, USAF Form 103 must be routed to all applicable base organizations for a clearance review. Circulation of this form is required to avoid contact with underground or overhead utilities, conflict with base activities, or breaches of security.

Additional safety procedures will be implemented, if warranted by the information review or conditions encountered at the site. Site-specific safety procedures will be based on guidelines given in the EPA Field Health and Safety Manual and the EPA Safety Manual for Hazardous Waste Site Investigations.

G-7.0 INCIDENT/ACCIDENT NOTIFICATION PROCEDURES

As a minimum, the following emergency phone numbers should be available on-site:

1. Ambulance or medical assistance,
2. Base fire department (or other if off-site), and
3. USAF contact for project.

warrant this procedure, all field personnel will participate in a medical monitoring program. Guidelines for the program are given in Appendix I of the EPA Field Health and Safety Manual (EPA, 1980).

G-4.0 FIELD PERSONNEL INDOCTRINATION

All field personnel will be informed by the project field supervisor of required safety equipment and procedures prior to on-site work. Subjects covered will include personal safety gear, general and site-specific safety procedures, and incident notification procedures.

G-5.0 PERSONNEL PROTECTION GEAR

The following items will be provided on-site for all field personnel:

- o Tyvek® disposable coveralls,
- o Rubber boots,
- o Rubber gloves,
- o Hard hats, and
- o Eye protection (safety glasses or face shields).

Hearing protection (disposable ear plugs) will be provided for all work in the vicinity of the flight line or other noise hazards. Cartridge-type respirators will be available on-site for protection against inhalation of dust or vapors. If strong vapors are encountered, respirators will be utilized to facilitate evacuation of personnel and equipment from the site until the situation can be assessed or corrected.

An Enmet CGS-18M portable gas detector will be used to monitor combustible or toxic gas concentrations during field work. For Phase II field work, normal alarm calibrations will be for methane (20 percent of the lower explosive limit) and methyl chloride (200 ppm).

Personal equipment described above will offer adequate protection for most situations encountered during the course of Phase II survey field work. When conditions are identified that require a higher level of

APPENDIX G

SAFETY PLAN

G-1.0 GENERAL

The safety plan presented herein gives guidelines for basic safety procedures and equipment utilized by Water and Air Research, Inc. (WAR) during the course of IRP Phase II surveys. Samples collected during Phase II surveys are typically environmental water and sediment samples as opposed to hazardous waste samples and normally do not require unusual levels of personnel protection. Detailed procedures and equipment required to minimize exposure to specific hazardous wastes or conditions requiring higher levels of protection are beyond the scope of this plan. References are provided from which waste-specific information on equipment and procedures can be obtained on a case-by-case basis.

G-2.0 INFORMATION REVIEW

Prior to initiating Phase II survey field work, the Phase I records search is reviewed in detail to identify hazardous wastes or conditions that may be encountered at each site. Available toxicological data on materials suspected of being present at the sites are reviewed to determine if the base level of personnel protection outlined in Section C-5.0 is adequate. Hazards such as the presence of highly toxic or incompatible chemicals, toxic gases, radioactive material, or explosives may require more extensive precautionary measures than the base level of protection. Safety hazards requiring special attention are addressed on an individual basis using appropriate assessment methods, and equipment and procedure recommendations given in the EPA Field Health and Safety Manual (EPA, 1980) and the EPA Safety Manual for Hazardous Waste Site Investigations (EPA, 1979). Hazardous conditions can be clarified or confirmed on preliminary site visits.

G-3.0 MEDICAL MONITORING PROGRAM

The person responsible for Phase II survey field work will determine whether a medical monitoring program is necessary, based on results of the information review. If hazard levels are judged high enough to

APPENDIX G
SAFETY PLAN

ring No. LF 4-13hole Size Slot reen Size Mat'l ising Size Mat'l ologist te Start 30 Oct 83 Finish ntractor iller Location Coordinates Filter Materials Grout Type Protective Casing Static Water Level Top of Well Elevation Drill Type

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		84-85.5	<u>SAND</u> , AS ABOVE. COLOR CHANGES TO PURPLE THEN RED-BRN (2.5 YR 5/4).	SP	
		89-90.5	89-90: <u>SAND</u> , AS ABOVE. 90-90.5: <u>SAND CLAYEY</u> . SD, VF-F, QTZ & MICA, ~80% SLT & CL, SOFT, SAT., WHITE (10 YR 3/2) STREAKED w/ WK. RED (7.5 YR 4/2).	SP SC-CL	
		94-95.5	<u>SAND</u> , <u>CLAYEY</u> . AS ABOVE.	SC-CL	
		99-100.5	<u>SAND</u> , <u>CLAYEY</u> , AS ABOVE. COLOR CHANGES TO RED-YELLOW (7.5 YR 8/6) AT ~ 100 FT.	SC-CL	

SHEET 1 OF 2

Boring No. LF 4-13

Hole Size 6" x 100' Slot 0.010'

Screen Size 2" x 75' Mat'l SCH 40 PVC

Casing Size 2" x 27.5' Mat'l SCH 40 PVC

Geologist W.D. ADAMS

Date Start 30 Oct 83 Finish 2 Nov 83

Contractor WAR/LETCO

Driller ROBERT BANKS

Location Coordinates 953,375.4 N

673,876.2 E

Filter Materials 20-30 SAND

Grout Type SD - CEMENT (2:1)

Protective Casing 5" x 5' B.I.P.

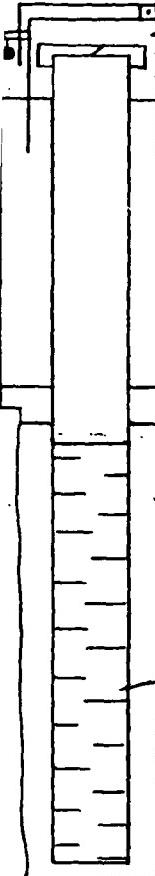
Static Water Level 41.00 FT

Top of Well Elevation 294.7 FT MSL

Drill Type CMV-55; 6" RCB

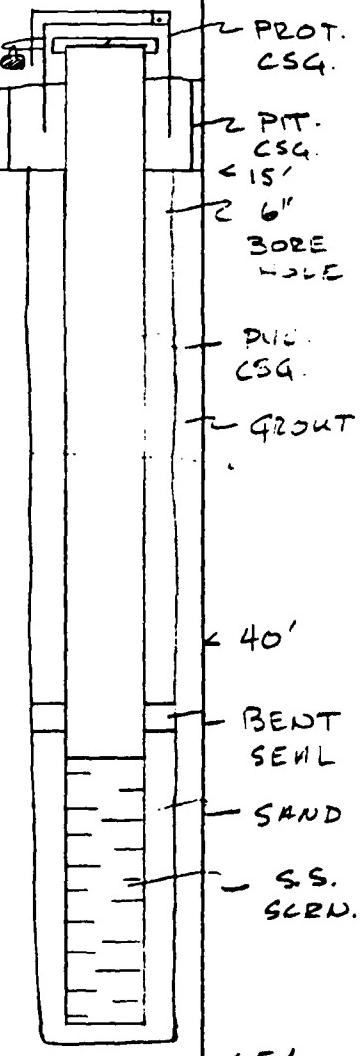
Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0-2	<u>SAND</u> , VF-F, QTZ, TR Hvy Min, ~20% SLT & CL, DRY LT YEL-BRN (2.5Y 6/4).	SP-SC	N.A.
		4-5.5	<u>SAND</u> , CLAYEY. SD, VF-F, QTZ, TR Hvy Min ~40% SLT & CL, DRY RED-YEL (7.5YR 7/3 WET)	SC	53
	< 5'	9-10.5	<u>CLAY</u> , <u>SANDY</u> . CL, E ~20% SLT & VF QTZ SD, DRY, WHITE (10YR 8/2) & PINK (5YR 3/4)	CL-SC	51
		14-15.5	<u>CLAY</u> , <u>SANDY</u> . AS ABOVE.	CL-SC	26
		19-20.5	<u>SAND</u> , VF-F, QTZ, TR Hvy Min, ANG, ~20% SLT & CL, DRY, WHITE & Y. PALE BRN (10YR 3/4).	SP-SC	32
		24-25.5	<u>SAND</u> , VF-F, QTZ, TR Hvy Min, ANG; ~5% SLT & CL, MOIST, WHITE.	SP	39
		29-30.5	<u>SAND</u> , CLAYEY. SD, VF-F, QTZ, TR Hvy Min, ~20% SLT & CL, MOIST, WHITE.	SC	39
		34-35.5	<u>SAND</u> , CLAYEY. AS ABOVE	SC	
		39-40.5	<u>SAND</u> , VF-F, QTZ, TR SET & CL, MOIST, SAT. IN LOWER PART, WHITE.	SP	36
		44-45.5	<u>SAND</u> , AS ABOVE, SATURATED.	SP	
		49-50.5	<u>SAND</u> , AS ABOVE, 1/2 STREAKS OF SANDY CLAY.	SP-SC	
		54-55.5	<u>SAND</u> , CLAYEY. SD, VF-F, QTZ, TR Hvy Min, TR V. CRS QTZ SD, ~30% SLT & CL SAT., WHITE.	SC	
		59-60.5	<u>SAND</u> , CLAYEY. AS ABOVE.	SC	
		64-65.5	<u>CLAY</u> , 1/2 TR VF SD (QTZ, D.O., MICA) & SLT, STEEP, MOIST, WHITE (10YR 8/2).	CL	
		69-70.5	<u>SAND</u> , VF-F, QTZ, TR D.O., ~5% SLT & CL, SATURATED, WHITE.	SP	
		74-75.5	<u>SAND</u> , VF-F, QTZ, TR D.O., TR SLT & CL, SATURATED, WHITE.	SP	
	100'	79-80.5	<u>SAND</u> , AS ABOVE EXCEPT YELLOW (2.5Y 8/6).		

SHEET 1 OF 1Location Coordinates 952, 94.6 N681, 147.5 EFilter Materials 20-30 SANDGrout Type SAND - CEMENTProtective Casing 5" x 5' IRONStatic Water Level 5.13 FTTop of Well Elevation 253.2 PT MSLDrill Type CME-55; 6" RCBPIT CSG: 8" x 15' IRON

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
			SEE LITH LOG FOR LF 4-10		

Boring No. LF 4-11
Hole Size 6" x 65' Slot 0.010"
Screen Size 2" x 15' Mat'l SCH 10 S.S.
Casing Size 2" x 52.5' Mat'l SCH 40 SS
Geologist W.D. Adams
Date Start 10 Nov 83 Finish 11 Nov 83
Contractor WAR/LET Co
Driller ROBT. BANKS

SHEET 1 OF 1
Location Coordinates 952, 995.7 N
681, 146.4 E
Filter Materials 20-30 SAND
Grout Type SAND - CEMENT.
Protective Casing 5" x 5' IRON
Static Water Level 5.08 FT
Top of Well Elevation 252.9 FT MSL
Drill Type CME - 55; 6" RCR.
PIT CSG: 8" x 15' IRON

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
			SEE LITH LOG FOR LF 4-10.		

Boring No. LF 4-10Hole Size SlotScreen Size Mat'1Casing Size Mat'1

Geologist _____

Date Start Finish

Contractor _____

Driller _____

Location Coordinates _____

Filter Materials _____

Grout Type _____

Protective Casing _____

Static Water Level _____

Top of Well Elevation _____

Drill Type _____

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		59-60.5	<u>SAND</u> , VF-E, QTZ, TR D.O., L SOFT CL (~10%), SAT., PALE RED (10 R 6/3).	SC	46
		64-65.5	<u>SAND</u> , VF-F, QTZ, ANG, ~5% SLT & CL, SAT., RED (7.5 R 4/8).	SP	26
		69-70.5	<u>SAND</u> , AS ABOVE. COLOR CHANGES AT BOTTOM TO RED-YEL. (7.5 YR 7/8).	SP	81
		74-75.5	<u>SAND</u> , CLAYBY. SD, VF-F, QTZ, TR D.O., ANG, ~20% SLT & CL, SAT., WK. RED (7.5 R 4/2).	SC	20
		~77-79	<u>CLAY</u> , TR SLT & V.F. SD, SOFT , V. DK. GRAY (N 3/1).	CH	N.A.
		79-80.5	CLAY, AS ABOVE, DRY.	CH	37
		84-85.5	84-85: <u>CLAY</u> , AS ABOVE EXCEPT SOFT, MOIST, YELLOW (10 YR 7/8) 85-85.5: <u>SAND</u> , CLAYEY, SIMILAR TO 75 FT SAMPLE.	CL	17
		89-90.5	<u>SAND</u> , CLAYEY. SD, VF-M, QTZ, TR D.O., ANG, ~20% SLT & CL, SAT. RED (10 R 6/8).	SC	26
		94-95.5	<u>SAND</u> , CLAYEY. SD, VF-F, QTZ, TR D.O., TR. MICA, ANG, ~30% SLT & CL, SAT., RED-YEL. (7.5 YR 7/8).	SC	17
		99-100.5	<u>SAND</u> , CLAYBY, AS ABOVE	SC	20

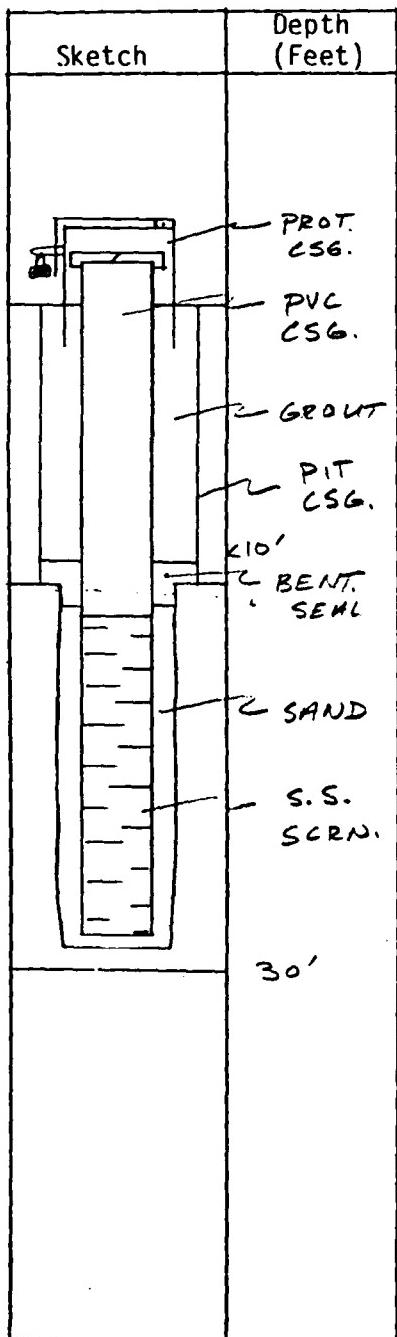
SHEET 1 OF 2Boring No. LF 4 - 10Hole Size 6" x 100' Slot 0.010"Screen Size 2" x 15' Mat'l SCN 10 S.S.Casing Size 2" x 37.5' Mat'l S' SCN 40 PVCGeologist W.D. ADAMSDate Start 8 Nov 83 Finish 10 Nov 83Contractor WAR / LET CODriller ROST. BANKSLocation Coordinates 953, 008.6 N681, 145.3 EFilter Materials 20-30 SANDGrout Type SAND - CEMENT.Protective Casing 5" x 5' IRONStatic Water Level 4.04 FTTop of Well Elevation 252.6 FT MSLDrill Type CME-55; 6" RCBPIT CSG: 3" x 15' IRON

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		0-3	<u>FULL. SANDY CLAY.</u>	CL	N.A.
		4-5.5	<u>NO RCVY.</u>	-	1
		4-9	<u>PEAT & MUCK, SATURATED, INSPECTED ON RETURNS.</u>	OH-PT	N.A.
		9-10.5	<u>9-10: PEAT, WOODY, SATURATED.</u>	PT	2
			<u>10-10.5: CLAY TR SLT & VF SD, SOFT, PLASTIC, SATURATED, LT. GRAY (10 YR 6/1).</u>	CL	-
		14-15.5	<u>CLAY, AS ABOVE INTERBEDDED w/ PEAT. CLAY AT 15.5 FT CHANGES TO YELLOW (10 YR 3/6).</u>	CL & PT	3
		19-20.5	<u>SAND, GRAVELLY, SD, VF-YC, QTZ, ~10% D.O., ANG, ~20% QTZ, ANG GRAVEL, TR SLT & CL, SATURATED, V. PALE BROWN (10 YR 7/4) & RED-YEL (7.5 YR 6/8), TR MICA.</u>	SW-GP	16
	75'	24-25.5	<u>SAND, VF-F, QTZ, SUB-ROUND, TR SLT & CL, SAT, YELLOW (10 YR 8/7).</u>	SP	53
		29-30.5	<u>SAND, VF-F, QTZ, TR D.O., ANG, TR SLT & CL, SAT, WHITE (10 YR 8/2).</u>	SP	46
		34-35.5	<u>SAND, AS ABOVE EXCEPT BROWN (7.5 YR 5/4).</u>	SP	47
		39-40.5	<u>SAND, AS ABOVE EXCEPT PINK (5 YR 8/4).</u>	SP	35
		44-45.5	<u>SAND, AS ABOVE EXCEPT TR SHELL FRAG, PINK (9.5 YR 7/4).</u>	SP	47
		49-50.5	<u>SAND, AS ABOVE EXCEPT PALE RED (2.5 YR 6/2).</u>	SP	48
	100'	54-55.5	<u>SAND, AS ABOVE EXCEPT DK BROWN-GRAY (2.5 YR 4/2).</u>	SP	59

SHEET 1 OF 1

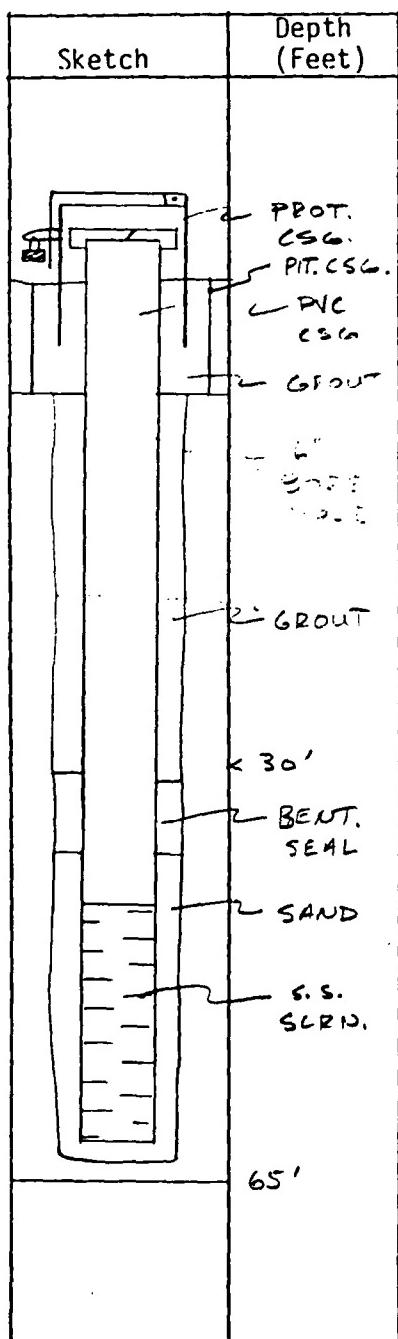
Boring No. LF 4-9
 Hole Size 6" x 30' Slot 0.010"
 Screen Size 2" x 15' Mat'l SCH 10 S.S.
 Casing Size 2" x 17.5' Mat'l SCH 10 S.S.
 Geologist W.D. ADAMS
 Date Start 5 DE 83 Finish 5 DE 83
 Contractor WAR/LETCO
 Driller H. CARNLEY

Location Coordinates 953, 241.7 N
681, 076.4 E
 Filter Materials 20-30 SAND
 Grout Type SD - CEMENT
 Protective Casing 5" x 5' IRON
 Static Water Level 6.35 FT
 Top of Well Elevation 254.0 FT MSL
 Drill Type FALLING 1500; 6" RCB
PIT CSG: 8" x 15' IRON

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
					

Boring No. LF 4-8
Hole Size 6" x 65' Slot 0.010"
Screen Size 2" x 15' Mat'l SCN 10 S.S.
Casing Size 2" x 52.5' Mat'l SCN 10 SS
SCH 40 PVC
Geologist W. D. ADAMS
Date Start 3 DE 83 Finish 4 DE 83
Contractor WAR/LET CO
Driller H. CARNLEY

SHEET 1 OF 1
Location Coordinates 953,244.3 N
681,085.9 E
Filter Materials 20-30 SAND
Grout Type SAND-CEMENT
Protective Casing 5" x 5' IRON
Static Water Level 3.86 FT
Top of Well Elevation 251.8 FT MSL
Drill Type FAILING 1500; 6" RCB.
PIT CSG: 3" x 15' IRON

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
	65'		SEE LIH LOG FOR LF 4-7		

SHEET 2 OF 2Boring No. LF 4-7

Hole Size _____ Slot _____

Screen Size _____ Mat'l _____

Casing Size _____ Mat'l _____

Geologist _____

Date Start _____ Finish _____

Contractor _____

Driller _____

Location Coordinates _____

Filter Materials _____

Grout Type _____

Protective Casing _____

Static Water Level _____

Top of Well Elevation _____

Drill Type _____

Sketch	Depth (Feet)	Sample	Lithology	USCS	SPT (BL/FT)
		94-95.5 99-100.5	<u>SAND</u> . <u>SAND</u> .	SP SP	42 49

APPENDIX H
QUALITY ASSURANCE/QUALITY CONTROL PLAN

APPENDIX H
QUALITY ASSURANCE/QUALITY CONTROL PLAN

H-1.0 ANALYTICAL QUALITY CONTROL

All field sampling and quality control spiking was performed by WAR. All sample analyses, with the exception of TOX, were performed by Technical Services, Inc. (TSI). TOX analyses were performed by Utah Biomedical Testing Labs (UBTL). Each of the above organizations maintains strict QA/QC plans which are outlined in separate documents which were not appended in this report due to their length. This appendix outlines QA/QC procedures directly relevant to the Robins AFB Phase IIb survey.

Accuracy of analytical techniques is assured by strict adherence to the methods listed in Table H-1. Integrity and representativeness of the sample are assured by sampling procedures described in Section H-2.0. A check on analytical quality control was provided by duplicating a minimum of 10 percent of the samples in each analysis lot. Additional samples were collected to provide for spiking 10 percent of cyanides, total phenolics, metals, pesticides, and PCBs samples. Samples for TOC, TOX, oil and grease, volatile aromatics (VOA), and volatile halocarbons (VOH) were not spiked. Duplicate and spike samples were labeled in such a way that the analytical laboratory could not identify them as duplicate or spiked samples. Results of duplicate and spike analyses are shown in Tables H-2 and H-3 and are discussed in the following sections.

H-1.1 OIL AND GREASE

Duplicates--0.8, 1.2 mg/l	Mean--1.0 mg/l
No spike.	

Accuracy of duplication was satisfactory for this parameter.

H-1.2 TOTAL PHENOLICS

Duplicates--7, 4 ug/l	Mean--5.5 ug/l
Duplicates--6, 4 ug/l	Mean--5 ug/l

Table H-1. Analytical Chemistry Methods for Water Samples, Robins AFB
 (Page 1 of 2)

Parameter	Method	Ref.	Detection Limit
pH*	EPA 150.1	1	--
Specific conductance*	EPA 120.1	1	--
Temperature*	EPA 170.1	1	--
Organic carbon	EPA 415.1	1	0.3 mg/l
Total organic halide	EPA 9020	2	--
Oil and grease	EPA 413.2	1	0.1 mg/l
Total phenolics**	EPA 420.1	1	1
Cyanide	Std. Meth. #412B, #413E	3	10
Metals			
Nickel	EPA 200.7	1	20
Copper	EPA 200.7	1	5
Zinc	EPA 200.7	1	10
Lead	EPA 200.7	1	30
Cadmium	EPA 200.7	1	5
Chromium	EPA 200.7	1	10
Mercury	EPA 245.1	1	0.2
Pesticides/PCBs			
Aldrin	EPA 608	4	0.02
DDT Isomers	EPA 608	4	0.02 each
Dieldrin	EPA 608	4	0.02
Endrin	EPA 608	4	0.02
Heptachlor	EPA 608	4	0.02
Heptachlor epoxide	EPA 608	4	0.02
Lindane	EPA 608	4	0.01
Methoxychlor	EPA 608	4	--
Chlordane	EPA 608	4	0.02
PCBs	EPA 608	4	0.25
Diazinon	EPA 614	5	0.02
Malathion	EPA 608	4	0.1
Parathion	EPA 614	5	0.02
2,4-D	Std. Meth. #509B	3	0.06
2,4,5-T	St. Meth. #509B	3	0.06
2,4,5-TP (Silvex)	St. Meth. #509B	3	0.02
Purgeable Organics			
Volatile organic halocarbons	EPA 601	4	†
Volatile organic aromatics	EPA 602	4	†

Table H-1. Analytical Chemistry Methods for Water Samples, Robins AFB
 (Page 2 of 2)

Parameter	Method	Ref.	Detection Limit
Priority Pollutants			
Base/neutral	EPA 625	4	††
Acid	EPA 625	4	††
Pesticide/PCBs	EPA 608	4	††
Acrolein and acrylonitrile	EPA 603	4	50

NOTE: All detection limits are in ug/l unless stated otherwise.

*Performed at the time of sample collection.

**EPA 420.1 will not detect 2,4-dinitrophenol, 2-methyl, 4,6-dinitrophenol, or 4-nitrophenol. This method may or may not detect 2,4-dimethylphenol.

†See Table 37 for detection limits (reported as "less than" values).

††See Table 36 for detection limits (reported as "less than" values except for di-n-butylphthalate, which is <1.0 ug/l D.L.).

1--EPA "Methods for Chemical Analysis of Water and Wastes," March 1979 - method number.

2--EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 2nd Edition, 1982.

3--"Standard Methods for the Examination of Water and Wastewater," 15th Edition, 1980 - method number.

4--EPA "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," July 1982 - method number.

5--EPA Interim Method, April 1979, EMSL, Cincinnati, OH, 45268.

Table H-2. Duplicate Values for Purgeable Organics Analyses, Robins AFB, December 1983

Parameter	LF1-3		LF4-6		LCH COMP.	
	15253	15271	15223	15274	15242A	15242B
<u>Volatile Halocarbons-All Units ug/l</u>						
Bromodichloromethane	<10	<100	<10	<100	<1	<1
Bromoform	<10	<100	<10	<100	<1	<1
Bromomethane	<10	<100	<10	<100	<1	<1
Carbon tetrachloride	<10	<100	<10	<100	<1	<1
Chlorobenzene	13	<100	290	<100	<1	<1
Chloroethane	<10	<100	290	<100	<1	<1
2-Chloroethylvinyl ether	<10	<100	290	<100	<1	<1
Chloroform	<10	<100	290	<100	<1	<1
Chloromethane	<10	<100	290	<100	<1	<1
Dibromochloromethane	<10	<100	290	<100	<1	<1
1,2-Dichlorobenzene	170	<100	4,410	2,710	<1	<1
1,3-Dichlorobenzene	20	<100	270	<100	<1	<1
1,4-Dichlorobenzene	105	100	2,750	1,710	<1	<1
Dichlorodifluoromethane	<10	<100	255	685	<1	<1
1,1-Dichloroethane	<10	<100	37	<100	<1	<1
1,2-Dichloroethane	<10	<100	100	<100	<1	<1
1,1-Dichloroethene	<10	<100	<10	<100	<1	<1
Trans-1,2-Dichloroethene	195	120	18,200	19,700	4	3
1,2-Dichloropropane	<10	<100	<10	<100	<1	<1
Cis-1,3-Dichloropropene	<10	<100	<10	<100	<1	<1
Trans-1,3-Dichloropropene	<10	<100	<10	<100	<1	<1
Methylene chloride	160	145	905	395	<1	<5
1,1,2,2-Tetrachloroethane	<10	<100	<10	<100	<1	<1
Tetrachloroethene	<10	<100	300	310	<1	<1
1,1,1-Trichloroethane	<10	<100	250	<100	<1	<1
1,1,2-Trichloroethane	<10	<100	<10	<100	<1	<1
Trichloroethene	33	<100	72,900	58,600	<1	<1
Trichlorofluoromethane	<10	<100	380	400	<1	<1
Vinyl chloride	<10	<100	<10	<100	<1	<1
<u>Volatile Aromatics-All Units ug/l</u>						
Benzene	8,800	5,490	<10	<100	<1	<1
Ethyl benzene	440	285	14	21	<1	<1
Toluene	11,600	7,030	300	325	<1	<1
Xylenes	14,600	3,930	145	155	<1	<1

Table H-3. Duplicate Values for Purgeable Organics Analyses, Robins AFB, March 1984

Parameter	LF1-3		LF4-6		WS-3	
	15428	15431	15444	15472	15465	15466
<u>Volatile Halocarbons-All Units ug/l</u>						
Bromodichloromethane	<1	<1	<1	<10		
Bromoform	<1	<1	<1	<10	<1	<1
Bromomethane	<1	<1	<1	<100	<1	<1
Carbon tetrachloride	<1	<1	<1	<100	<1	<1
Chlorobenzene	2	<1	240	<10	<1	<1
Chloroethane	<1	<1	<1	<100	<1	<1
2-Chloroethylvinyl ether	<1	<1	<10	<100	<1	<1
Chloroform	<1	<1	<100	<10	4	1
Chloromethane	<1	<1	<1	<100	<1	<1
Dibromochloromethane	<1	<1	<100	<100	<1	<1
1,2-Dichlorobenzene	84	88	500	510	<1	<1
1,3-Dichlorobenzene	6	8	280	435	<1	<1
1,4-Dichlorobenzene	35	46	280	<100	<1	<1
Dichlorodifluoromethane	<1	<1	<1	<100	<1	<1
1,1-Dichloroethane	<1	<1	<100	<100	<1	<1
1,2-Dichloroethane	<1	<1	76	<10	<0.1	<0.1
1,1-Dichloroethene	<1	<1	<1	<10	<1	<1
Trans-1,2-Dichloroethene	<10	<10	<10	<10	<1	<1
1,2-Dichloropropane	<1	<1	6	<10	<1	<1
Cis-1,3-Dichloropropene	<1	<1	<100	<100	<1	<1
Trans-1,3-Dichloropropene	<1	<1	<1	<10	<1	<1
Methylene chloride	<1	<1	760	1,100	<1	<1
1,1,2,2-Tetrachloroethane	<1	<1	<1	<100	<1	<1
Tetrachloroethene	<1	<1	220	<10	<1	<1
1,1,1-Trichloroethane	<1	<1	105	<100	<1	<1
1,1,2-Trichloroethane	<1	<1	<100	<100	<1	<1
Trichloroethene	225	190	124,000	140,000	<10	<1
Trichlorofluoromethane	<1	<1	<1	<10	<1	<1
Vinyl chloride	<1	<1	165	<100	<1	<1
<u>Volatile Aromatics-All Units ug/l</u>						
Benzene	<10	15	125	880	<0.7	<0.7
Ethyl benzene	<1	56	150	23	<1	<1
Toluene	515	645	365	540	<1	<1

Duplicates--4, 9 ug/l	Mean--6.5 ug/l
Duplicates--5, 1 ug/l	Mean--3 ug/l

Spike recoveries were 49, 89, 71, and 215 percent at levels of 5.1, 4.5, 9.1, and 22.8 ug/l, respectively. Average recovery was 106 percent.

Duplication of these samples was acceptable for the matrices involved; however, the spike recoveries were not as close as desired (erratic) or as close as those of previous sampling efforts (e.g., Eglin and Tyndall AFBs). Matrix interference could be involved in the deviations from total recovery.

H-1.3 DOC

Duplicates--<0.3, <0.3 mg/l	Mean--<0.3 mg/l
Duplicates--<0.3, <0.3 mg/l	Mean--<0.3 mg/l
Duplicates--9.6, 9.6 mg/l	
Duplicates--<0.3, <0.3 mg/l	Mean--<0.3 mg/l
No spike.	

Duplication of these samples was above average for the matrices involved and are considered satisfactory.

H-1.4 TOX

Duplicates--<10, <10 ug/l	Mean--<10 ug/l
Duplicates--80, 100 ug/l	Mean--95 ug/l
Duplicates--110, 100 ug/l	Mean--105 ug/l
No spike.	

Duplication of these samples was acceptable for the matrices involved.

H-1.5 METALS (DISSOLVED)

Table H-4 lists duplicate and spike data on each individual metal (nickel, copper, lead, zinc, chromium, and cadmium).

Table H-4. Results of Blinded Duplicate and Spiked Metal Samples, Robins AFB, December 1983

	Nickel ug/l	Copper ug/l	Lead ug/l	Zinc ug/l	Chromium ug/l	Cadmium ug/l
Sample #1	<20	<5	44	13	<10	<5
Sample #2	<20	<5	<30	15	<10	<5
Spike Conc./ Reported Conc.	70/50	35/35	14/5	35/29	35/27	7/<5
% Recovery	72	100	36	83	78	*
Sample #1	<20	<5	<30	54	<10	<5
Sample #2	<20	<5	<30	1,277	<10	<5
Spike Conc./ Reported Conc.	108/116	54/52	22/<30	54/556	54/46	11/13
% Recovery	108	97	**	†	86	120
Sample #1	<20	<5	<30	<10	<10	<5
Sample #2	<20	<5	<30	22	<10	<5
Spike Conc./ Reported Conc.	98/97	49/49	20/<30	49/70	49/51	10/7
% Recovery	99	100	**	142	104	70
Sample #1	<20	14	<30	39	<10	<5
Sample #2	<20	16	<30	57	<10	<5
Spike Conc./ Reported Conc.	71/66	36/33	14/<30	36/39	36/34	7/7
% Recovery	92	92	**	109	95	100

Note: Reported concentration is minus background concentration.

*No spike recovery calculable.

**Spike concentration near or below detectable limit.

†Duplicate samples disagree--no spike recovery calculable.

With the exception of one extreme deviation (zinc value at LF4-12) duplication and recovery of the metal analytes were satisfactory. There is some indication of possible matrix interferences with zinc as evidenced in more than one sample.

H-1.6 CYANIDE

December 1983

Duplicates--<20, <20 ug/l	Mean--<20 ug/l

Spike recoveries were 6, 13, 35, and 63 percent at levels of 16, 23, 32, and 70 ug/l, respectively. Holding times were exceeded on these samples and the poor recoveries at the lower concentrations reflect this factor.

The detection limit for the December 1983 cyanide data is estimated at 20 ug/l. This is based upon:

1. Minimum standard used for calibration was 5 ug/l;
2. Minimum field spike concentration was 16 ug/l;
3. Uncertainty of the calibration curves (90 percent confidence) is 18 ug/l; and
4. Poor field spike recovery when total concentration is 20 to 30 ug/l.

Stations scheduled for cyanide analysis were resampled in March since the December samples were analyzed past their holding times.

March 1984

Duplicates--<10, <10 ug/l	Mean--<10 ug/l
Duplicates--<10, <10 ug/l	Mean--<10 ug/l
Duplicates--160, 175 ug/l	Mean--168 ug/l
Duplicates--<10, <10 ug/l	Mean--<10 ug/l

Spike recoveries were 20, 74, 129, and 142 percent at levels of 8, 37, 35, and 9 ug/l, respectively.

The detection limit for the March 1984 cyanide data is estimated at 10 ug/l. This is based upon:

1. Minimum standard used for calibration was 5 ug/l;
2. Minimum field spike concentration used was 8 ug/l;
3. Uncertainty of the calibration curves (90 percent confidence) is 6 ug/l;
4. Lack of field spike recovery when total concentration is below 10 ug/l.

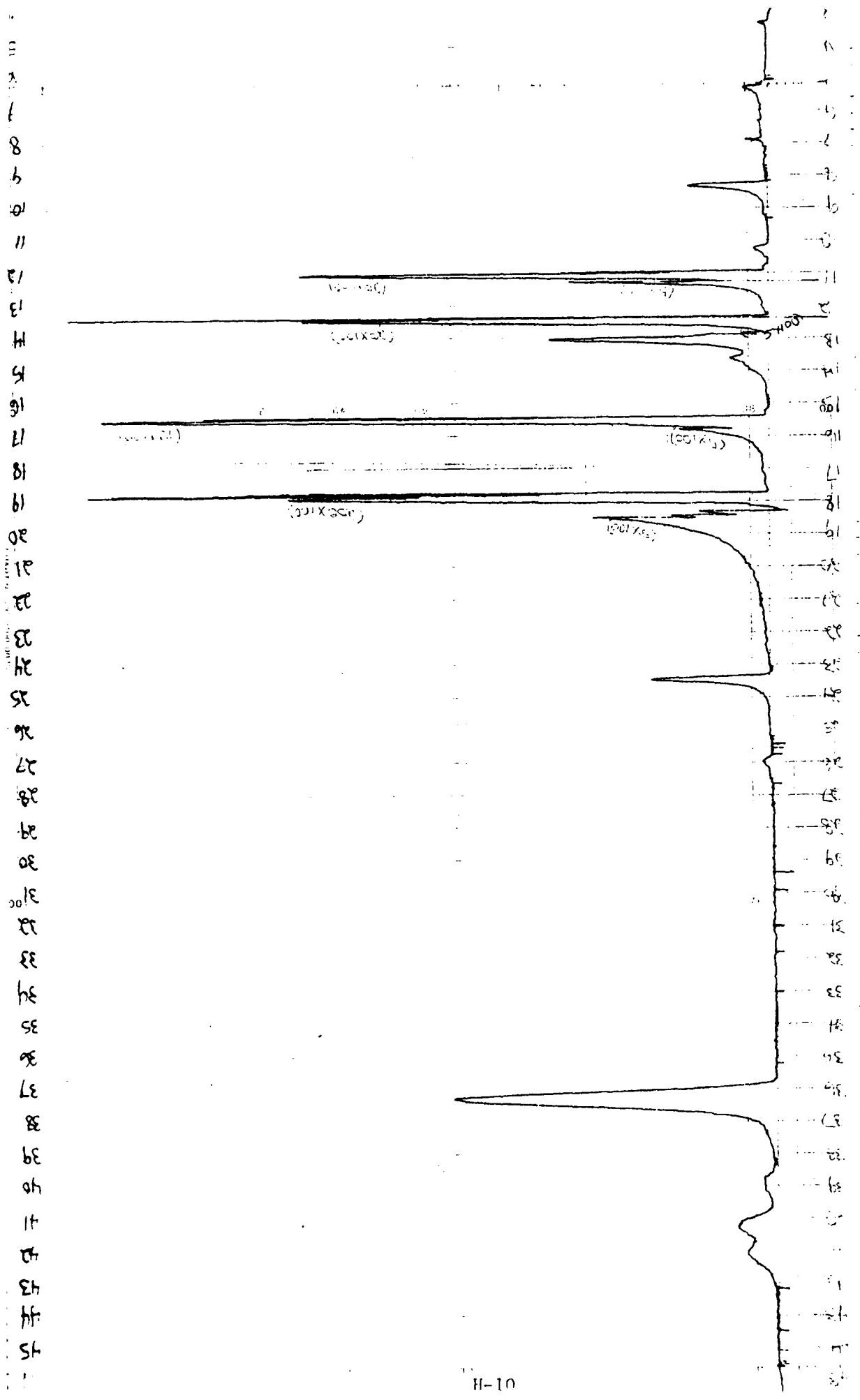
An audit of the subcontracting laboratory revealed that internal spike recoveries ranged from 80 to 120 percent. The internal laboratory duplicate analysis also showed acceptable results; therefore, the poor recovery of the field QC spikes is attributable to matrix interferences.

H-1.7 PURGEABLES

Tables H-2 and H-3 list duplicate data on the individual purgeable compounds.

Volatiles analyses are perhaps the most difficult trace organic analyses from which to obtain consistent duplication and recovery. The possibility of a nonhomogeneous matrix, (e.g., a biphasic system) may prevent representative duplicate sampling. This type of matrix can also adversely impact the detection limits of certain compounds due to "swamping" or masking by volatile components present in great concentration. Example chromatograms of a purgeable sample with few interferences and another sample with gross interferences are shown in Figure H-1 and H-2, respectively. In view of these observations, some of the results in Tables H-1 and H-2 reflect the difficulty of the analytical situation. However, the bulk of the results is satisfactory for the sample condition.

FIGURE H-1. Robins AFB, Example Purgeable Organics Chromatogram



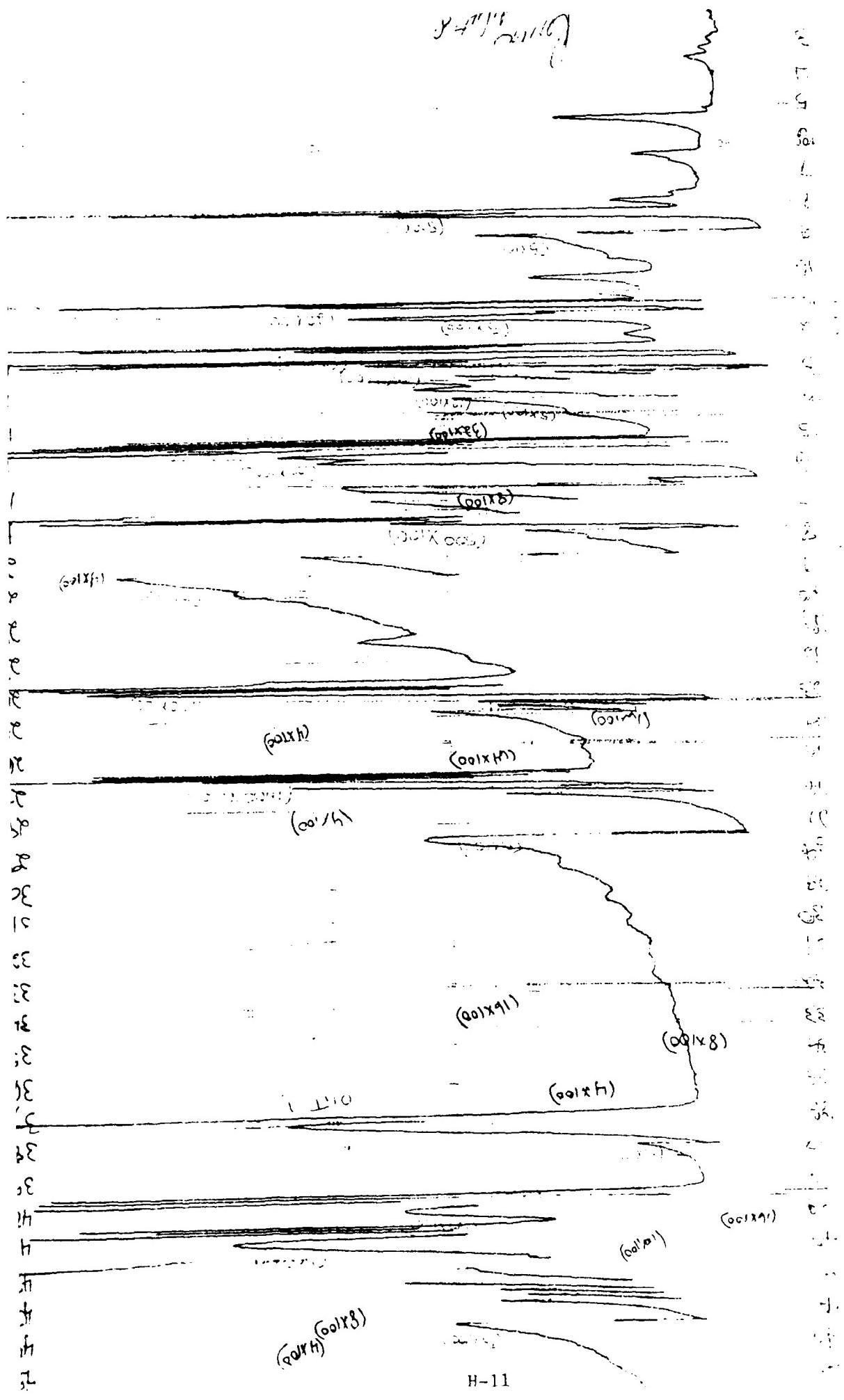


FIGURE H-2. Robins AFB, Example Purgeable Organics Chromatogram.

A second sampling effort was conducted in March 1984 for purgeable organics since holding times for the December 1983 samples were exceeded. Therefore, the December 1983 purgeables data presented throughout this report and in Table H-1 are suspected of not reflecting the true concentrations of contaminants found in the samples. In addition, the March 1984 analytical effort included confirmation analyses as per the letter received from OEHL dated 8 March 1984. These confirmatory analyses eliminated several large peaks which had been identified as priority pollutant volatiles.

H-1.8 PESTICIDES

Due to the small number of pesticide samples taken, no spike analyses were conducted. Duplicate values (in ug/l) are as follows:

Aldrin--<0.02, <0.02	Heptachlor epoxide--<0.02, <0.02
Dieldrin--<0.02, <0.02	DDT-R--<0.02, <0.02
Endrin--<0.02, <0.02	Methoxychlor--<0.02, <0.02
Lindane--<0.01, <0.01	Chlordane--<0.02, <0.02
Heptachlor--<0.02, <0.02	

The extraction holding times were exceeded for the December 1983 samples. No external (field) duplication was performed on the March 1984 resampling effort.

H-2.0 SAMPLING INSTRUCTIONS FOR ROBINS AFB

Descriptions of sample containers, preservation methods, and holding times are given in Table H-5. Sampling procedures are outlined below for each analysis group.

H-2.1 PURGEABLE ORGANICS

This sample should come from the first aliquot of a bailer to prevent the loss of any volatiles. Avoid excess turbulence (e.g., bubbling) when filling these bottles for the same reason. Fill bottle to an inverted meniscus, cap, and refrigerate immediately. A small convex dimple in the top of the septum indicates that the bottle is properly filled. There

Table H-5. Sample Containers, Preservation Methods, and Holding Times

Parameter	Sample Type	Container/ Volume	Method of Preservation (Filtration, pH, etc.)	Holding Time
Oil and grease	W*	Glass, 1 qt. Teflon liner in cap	Conc. H_2SO_4 to pH <2, chill to 4°C	28 days
Phenols	W	Glass, 1 qt.	Conc. H_2SO_4 to pH <2, chill to 4°C	28 days
Metals (diss.)	W	Plastic, 4 oz.	Filter, conc. HNO_3 to pH <2	6 months
	S†	Glass, 1 qt.		
TOX	W	Glass, 40 ml (2) Teflon septa	No headspace in vial, chill to 4°C	14 days
DOC	W	Plastic, 4 oz.	Filter, conc. HCl to pH <2, chill to 4°C	28 days
Purgeables	W,S	Glass, 40 ml (4) Teflon septa	No headspace in vial, chill to 4°C	14 days
Pesticides**	W,S	Glass, 1 qt. Teflon liner in cap	Chill to 4°C	7 day extr., 40 day analysis
Herbicides	W	Glass, 1 qt. Teflon liner in cap	Conc. HCl to pH <2, chill to 4°C	40 day analysis
	S	Glass, 1 qt. Teflon liner in cap	Chill to 4°C	40 day analysis
Cyanide	W	Plastic, 1 qt.	NaOH to pH >12, chill to 4°C	14 days
	S	Glass, 1 qt.	Chill to 4°C	

*W = Water.

†S = Sediment.

**Organochlorine and organophosphate.

Source: U.S. Environmental Protection Agency (EPA). 1982. Technical Additions to Methods for Chemical Analysis of Water and Wastes, Table 1. EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio. EPA-600/4-82-055, December 1982.

ROBINS AFB FIELD SAMPLE SHEET

Later and Air Research, Inc.
821 S.W. Archer Road
P.O. Box 1121
Lainesville, FL 32602
Phone: 904/372-1500

Sampled by: RAB/JWR/DPC
Date: 12/15/83
Time: 1140

Sampling Site/Well No.: LF4-9
Sampling Location Description: ZONE 1 - LANDFILL 4

Groundwater Samples

Depth to water surface 6' 4 1/4"

Surface Water and Sediment Samples

Total Depth _____

Height of water column ~ 24'

Sample Depth(s) _____

pH 5.3

pH _____

Sp. cond. 60 @ 18°C

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
<u>15226</u>	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2, 4°C	<u>TP 9</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2, 4°C	<u>M12</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	<u>8</u>
	40 ml glass	TOX ✓	Chill to 4°C	<u>X35, 36</u>
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 15</u>
	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO 12</u>
↓	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN 38</u>

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: BAILED 24 gal. PRIOR TO SAMPLING. WATER TURBO, TAN COLORED.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB/JWR/DPCDate: 12/15/83Time: 1225

Sampling Site/Well No.: LF 4 - 8
Sampling Location Description: ZONE 1 - LANDFILL 4

Groundwater Samples

Depth to water surface 3' 10 1/2"Height of water column ~61'pH 5.8Sp. cond. 55 @ 20°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	
<u>15225</u>	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH 2, 4°C	<u>TP 12</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH 2, 4°C	<u>M 8</u>
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX ✓	Chill to 4°C	<u>X 39, 40</u>
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 18</u>
	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO 9</u>
↓	1 qt. plastic	Cyanide ✓	NaOH to pH 12, 4°C	<u>CN 22</u>

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: PUMPED * 61 gal PRIOR TO SAMPLING. WATER STARTED SLIGHTLY TURBID BUT CLEARED UP.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB/JWR/DPC

Date: 12/15/83

Time: 1150

Sampling Site/Well No.: LF4-7
Sampling Location Description: ZONE 1 - LANDFILL 4

Groundwater Samples

Depth to water surface 3'5"

Height of water column ~97'

pH 5.6

Sp. cond. 40 @ 19°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
<u>15224</u>	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	_____
	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2,4°C	<u>TP10</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2,4°C	<u>M13</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	_____
	40 ml glass	TOX ✓	Chill to 4°C	<u>X37,38</u>
	4 oz. plastic	DOC ✓	HCl to pH<2	<u>TOC 13</u>
	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO 7</u>
↓	1 qt. plastic	Cyanide ✓	NaOH to pH>12,4°C	<u>CN39</u>

Sediment Samples

_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED 97 gal. PRIOR TO SAMPLING. WATER STARTED TURBED, BUT CLEARED UP WITH VERY LITTLE TURBIDITY & COLOR.

FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDS/JWR/DPC
Date: 12/15/83
Time: 1325

Sampling Site Well No.: LF 4 - 46
Sampling Location Description: ZONE 1 - SLUDGE LAGOON

Groundwater Samples

Depth to water surface 7'5 $\frac{1}{2}$ "

Height of water column ~18'

pH 5.4

Sp. cond. 290 @ 19.5°C

~~Surface Water and Sediment Samples~~

Total Depth

Sample Depth(s)

pH

Sp. cond.

<u>Sample No.</u>	<u>Container</u>	<u>Parameters to be Analyzed</u>	<u>Preservation Method</u>	<u>Container No.</u>
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH 2,4°C	
<u>15223</u>	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH 2,4°C	<u>TP 52</u>
	4 oz. plastic	Heavy Metals ~	HNO ₃ to pH 2,4°C	<u>M 1</u>
	8 oz. plastic	Mercury	HNO ₃ to pH 2,4°C	
	40 ml glass	TOX ~	Chill to 4°C	<u>X 43, 44</u>
	4 oz. plastic	DOC O	HCl to pH <2	<u>TOC 28</u>
<u>15274</u>	40 ml glass	Purgeables O	Chill to 4°C	<u>PO 23, 25</u>
V	1 qt. plastic	Cyanide ✓ -	NaOH to pH 12,4°C	<u>CN 7</u>

Sediment Samples

	Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: BAILED 18 gal. PRIOR TO
SAMPLING. WATER TURBID, GREY-BRN., SEPTIC
ODOR, FAINT SOLVENT ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB/JWR/DPC
Date: 12/15/83
Time: 1320

Sampling Site/Well No.: LF 4-5

Sampling Location Description: ZONE 1 - SLUDGE LAGOON,
EAST SIDE

Groundwater Samples

Depth to water surface 7 1/2'

Height of water column ~ 43'

pH 5.6

Sp. cond. 32 @ 20°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
<u>15222</u>	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2, 4°C	<u>TP 51</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2, 4°C	<u>M 7</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
	40 ml glass	TOX ✓	Chill to 4°C	<u>X 45, 46</u>
<u>15273</u>	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 30, 38</u>
	40 ml glass	Purgeables	Chill to 4°C	_____
↓	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN 3</u>

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
	40 ml glass	Purgeables	Chill to 4°C	_____
	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED 43 gal. PRIOR TO
SAMPLING. WATER CLEAR, NO DETECTABLE ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: JWR/DPC
Date: 12/15/83
Time: 1500

Sampling Site/Well No.: LF 4-4
Sampling Location Description: ZONE 1 - SLUDGE LAGOON
WEST SIDE

Groundwater Samples

Depth to water surface 8' 3 1/4"
Height of water column ~ 17'
pH 5.6
Sp. cond. 160 @ 16°C

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) _____
pH _____
Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
<u>15221</u>	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	<u>TP 50</u>
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	<u>M3</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	<u>X 49, 50</u>
	4 oz. plastic	DOC	HCl to pH <2	<u>TOC 27</u>
	40 ml glass	Purgeables	Chill to 4°C	<u>PO 19</u>
↓	1 qt. plastic	Cyanide	NaOH to pH 12, 4°C	<u>CN 12</u>

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: BAILED ~ 17 gal. PRIOR TO SAMPLING.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: JWR / OPC

Date: 12/15/83

Time: 1445

Sampling Site/Well No.: LF 4-3
Sampling Location Description: ZONE 1 - SLUDGE LAGOON
WEST SIDE

Groundwater Samples

Depth to water surface 8' 1/2"

Height of water column ~ 42'

pH 5.8

Sp. cond. 48 @ 19°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
<u>15220</u>	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	_____
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	<u>TP 49</u>
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	<u>M2</u>
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	_____
	40 ml glass	TOX	Chill to 4°C	<u>X 47, 48</u>
	4 oz. plastic	DOC	HCl to pH <2	<u>TOC 19</u>
	40 ml glass	Purgeables	Chill to 4°C	_____
↓	1 qt. plastic	Cyanide	NaOH to pH >12, 4°C	<u>CNG</u>

Sediment Samples

_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED* 42 gal PRIOR TO
SAMPLING. WATER SLIGHTLY TURBID,

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: JWR / DPC
Date: 12/16/83
Time: 0930

Sampling Site/Well No.: LF 4-2

Sampling Location Description: ZONE 1 - HANNAH RD.
ON SHOULDER OF RD. ABOUT 15-20' FROM 4-1

Groundwater Samples

Depth to water surface 4' 8"Height of water column ~45'pH 4.6Sp. cond. 21 @ 18°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
218, 15266, 15272	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	4 oz. plastic	Phenols	H ₂ SO ₄ to pH<2, 4°C	TP <u>22, 30, 23</u>
	8 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	M <u>33, 51, 36</u>
	40 ml glass	Mercury	HNO ₃ to pH<2, 4°C	
	4 oz. plastic	TOX	Chill to 4°C	X <u>83, 84</u> / 57, 58
	40 ml glass	DOC	HCl to pH<2	TOC <u>42, 4</u>
	40 ml glass	Purgeables	Chill to 4°C	
↓ 15272	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	CN <u>16, 24</u> , 15

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: PUMPED 45 gal. PRIOR TO SAMPLING. WATER CLEAR, NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: JWR / DPC
Date: 12/16/83
Time: 0900

Sampling Site/Well No.: LF4-1
Sampling Location Description: ZONE 1 - HANNAH RD.

Groundwater Samples

Depth to water surface 2' 4"
Height of water column ~ 98'
pH 4.8
Sp. cond. 21 @ 18°C

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) _____
pH _____
Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
<u>15218</u>	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	<u>TP 26</u>
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	<u>M 41</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	<u>X 81, 82</u>
	4 oz. plastic	DOC	HCl to pH <2	<u>TOC 52</u>
	40 ml glass	Purgeables	Chill to 4°C	
↓	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	<u>CN 18</u>

Sediment Samples

	Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: PUMPED 98 gal. PRIOR TO SAMPLING. WATER TURBID, NO ODOR.

DECEMBER 1983 SAMPLING

APPENDIX I
FIELD DATA SHEETS

priority pollutants fractions (purgeables, base/ neutrals, etc.) and refrigerated until analysis.

H-2.9 CYANIDE

Do not fill bottles completely in order to leave room for the addition of the spiking solution. Preserve with concentrated NaOH (12 N) to a pH >12. Refrigerate after preservation.

H-2.10 pH AND SPECIFIC CONDUCTANCE

Meters were standardized daily in the field using solutions prepared in the WAR laboratory. Back-up meters and solutions were available at all times in the company vehicle on-site.

5 N H₂SO₄ is used for rinsing and concentrated H₂SO₄ is used for preservation. These samples require refrigeration.

H-2.4 OIL AND GREASE

Due to the nature of the analyte, do not fill sample bottles completely. Bottles are 1-liter amber glass with foil-lined caps. Preserve oil and grease samples by adjusting the pH below 2 with concentrated HCl and refrigerating the sample.

H-2.5 PHENOLICS

Do not fill bottles completely in order to leave room for addition of spike solution. Preserve with concentrated H₂SO₄ (using disposable glass pipets) to a pH <2. Refrigerate after acidification.

H-2.6 TOX

The procedure for TOX is the same as that used for purgeable organics except the sample is taken in duplicate.

H-2.7 PCBs/PESTICIDES (INCLUDING HERBICIDES)

Samples are taken in 1-quart glass bottles with Teflon lid-liners. Separate 1-quart fractions are taken for the organochlorine pesticides, the organophosphate pesticides, and the herbicides. The herbicides are preserved with concentrated HCl to pH <2. All fractions are chilled to 4°C. NOTE: Exercise care in sampling surface waters to prevent inclusion of excessive amounts of silt and debris disturbed from the bottom of the site.

H-2.8 PRIORITY POLLUTANTS (COMPOSITE)

Samples to be composited are taken in 1-gallon, amber glass jugs with Teflon lid-liners. Bottles are filled completely (no headspace) and chilled to 4°C to minimize the loss of volatile components before compositing. Equal volumes of each sample (approximately 1,300 milliliters) are combined in a separate empty 1-gallon jug and mixed thoroughly. Aliquots are then drawn from the composited sample for the various

should be no air bubbles present in the bottle. This sample is taken in quadruplicate in 40 milliliter glass, screw-cap vials with Teflon septa. Preservation is by refrigeration.

H-2.2 METALS

Metal samples from the wells should be from the first bailer (1 liter). The bottle should be filled to the very top if dissolved metals are desired and filtration is not performed immediately.

Filtration should be as follows:

1. Rinse a glass fiber filter with 20 to 30 milliliters of 0.5 N HNO₃ after placing the filter in the suction apparatus. Discard the rinsate.
2. Rinse the filter with 20 to 30 milliliters of sample. Discard the rinsate.
3. Filter the sample and return it to the bottle after rinsing the bottle with deionized water.
4. For membrane filtration, place the filter in the filtration apparatus with the gridded side up and follow steps 1 through 3; preserve the sample with concentrated HNO₃.
5. Samples must be filtered through the 0.45-micrometer filter for analytes to be considered dissolved. Filtration through a glass fiber filter reduces "binding" of the membrane filter but may not be needed for samples with little turbidity.

After filtration, preserve metal samples by adding 2 milliliters of HNO₃ per liter of sample. Mix thoroughly and check the pH by pouring a small amount of the sample on a pH test strip. If the pH is not less than 2, add more HNO₃. Refrigeration of preserved metals samples is not necessary.

H-2.3 DOC

Fill the sample bottle completely to ensure sufficient sample after filtration. This procedure is the same as that for metals except

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB/JWR/DPC
Date: 12/15/83
Time: 1025

Sampling Site/Well No.: LF 4-10
Sampling Location Description: ZONE 1 - LANDFILL 4

Groundwater Samples

Depth to water surface 4 1/2"

Height of water column ~ 96'

pH 6.1

Sp. cond. 31 @ 21°C

Surface Water and Sediment Samples

Total Depth

Sample Depth(s)

pH

Sp. cond.

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
<u>18227</u>	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2, 4°C	<u>TP 7</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2, 4°C	<u>M25</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX ✓	Chill to 4°C	<u>X31, 32</u>
	4 oz. plastic	DOC ✓	HCl to pH<2	<u>TOC 32</u>
	40 ml glass	Purgeables	Chill to 4°C	
↓	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN 35</u>

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: PUMPED* 96 gal PRIOR TO SAMPLING. WATER TURBID, YELLOW-BRN., NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB/JWR/DPC
Date: 12/15/83
Time: 1010

Sampling Site/Well No.: LF4 - 11
Sampling Location Description: ZONE 1 - LANDFILL 4

Groundwater Samples

Depth to water surface 5' 1"

Height of water column ~60'

pH 5.4

Sp. cond. 26 @ 19°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
<u>15228</u>	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	<u>TP 6</u>
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	<u>M14</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	<u>X29, 30</u>
	4 oz. plastic	DOC	HCl to pH <2	<u>TOC 40</u>
	40 ml glass	Purgeables	Chill to 4°C	
↓	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	<u>CN 47</u>

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Bailed
Comments and additional observations: BAILED ~~BAILED~~ 60 gal PRIOR TO
SAMPLING. WATER TURBID, DK. YELLOW-BRN.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDS/JWR/DOC
Date: 12/15/83
Time: 0950

Sampling Site/Well No.: LF 4-12
Sampling Location Description: ZONE 1 - LANDFILL 4

Groundwater Samples

Depth to water surface 5' 1/2"

Height of water column ~25'

pH 5.4

Sp. cond. 39 @ 19°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
5229, 15267, 15275	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2, 4°C	TP 3, 4, 5
↓	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2, 4°C	M 16, 18, 11
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX ✓	Chill to 4°C	X25, 26/27, 28
	4 oz. plastic	DOC ✓	HCl to pH<2	TOC 22, 50
	40 ml glass	Purgeables	Chill to 4°C	
↓ 15275	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	CN 40, 44, 48

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: * PLUMBED 30 gal. PRIOR TO
SAMPLING. WATER SLIGHTLY TURBID, PALE YELLOW,
NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: DPC / JWR
Date: 12/15/83
Time: 1730

Sampling Site/Well No.: LF 4-13

Sampling Location Description: UPGRADIENT WELL FOR LF 1, 2
#4

Groundwater Samples

Depth to water surface 41' 0"

Height of water column ~59'

pH 5.4

Sp. cond. 37 @ 11°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
<u>15230</u>	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2, 4°C	<u>IP2D</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2, 4°C	<u>M40</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX ✓	Chill to 4°C	<u>X79, 80</u>
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 3</u>
	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO27</u>
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN 8</u>

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: PUMPED WITH SUBMERSIBLE PUMP @ 10 gal/hr. FOR 6 HR. WATER CLEAR BUT FLOW WAS EXTREMELY LOW (~ 0.1 gal/min.).

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RAB
Date: 12/15/83
Time: 1050

Sampling Site/Well No.: LF 4-14 SW F SED
Sampling Location Description: ADJACENT TO LF 4-10 THRU 12,
ZONE 1, LANDFILL 4

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @ _____

Surface Water and Sediment Samples

Total Depth 6 - 8 "
Sample Depth(s) SURFACE, ~1 FT.
pH 5.7
Sp. cond. 210 @ 12.5°C

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
_____	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
15231	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
_____	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2, 4°C	TP 8
_____	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2, 4°C	M 6
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
_____	40 ml glass	TOX ✓	Chill to 4°C	X 33, 34
_____	4 oz. plastic	DOC ✓	HCl to pH <2	TOC 48
_____	40 ml glass	Purgeables	Chill to 4°C	_____
↓	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	CN 29

Sediment Samples

_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
15233	1 qt. glass	Metals, Phenols, ✓ Cyanide	Chill to 4°C	MS-1

Comments and additional observations: WATER HIGHLY COLORED,
THICK LEAF MOLD & DETRITUS UNDER WATER
SURFACE. VERY BOGGY CONDITIONS, SOME EVIDENCE
OF IRON BACTERIA (SHEEN).

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 12/15/83
Time: 1205

Sampling Site/Well No.: LF 4-15 SW & SED.
Sampling Location Description: ADJACENT TO LF4-7 THRU 9,
ZONE 1, LANDFILL 4

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @ _____

Surface Water and Sediment Samples

Total Depth 4-6"
Sample Depth(s) SURFACE
pH 6.6
Sp. cond. 135 @ 13°C

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
<u>15232</u>	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	_____
	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH 2, 4°C	<u>TP 53</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH 2, 4°C	<u>M5</u>
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	_____
	40 ml glass	TOX ✓	Chill to 4°C	<u>X41, 42</u>
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 36</u>
	40 ml glass	Purgeables	Chill to 4°C	_____
↓	1 qt. plastic	Cyanide ✓	NaOH to pH >12, 4°C	<u>CN 2</u>

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
	40 ml glass	Purgeables	Chill to 4°C	_____
<u>15234</u>	1 qt. glass	Metals, Phenols, Cyanide	Chill to 4°C	<u>MS-2</u>

Comments and additional observations: WATER & AREA MUCH THE
SAME AS 4-14, BUT CLEAR OF VEGETATION.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 12/15/83
Time: 1700

Sampling Site/Well No.: LF 4 - 16 SW & SEO.
Sampling Location Description: ZONE 1 - SLUDGE LAGOON

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @

Surface Water and Sediment Samples

Total Depth 10 - 12 "
Sample Depth(s) SURFACE
pH 6.0
Sp. cond. 82 @ 26°C

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
<u>15235</u>	1 qt. glass	Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	<u>CP 1</u>
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2,4°C	<u>TP 19</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2,4°C	<u>M 4</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	
	40 ml glass	TOX ✓	Chill to 4°C	<u>X 77, 78</u>
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>T 05</u>
	40 ml glass	Purgeables ✓	Chill to 4°C	<u>P 0 10</u>
↓	1 qt. plastic	Cyanide ✓	NaOH to pH>12,4°C	<u>CN 17</u>
Sediment Samples				
<u>15236</u>	1 qt. glass	Pesticides, PCBs ✓	Chill to 4°C	<u>CPS-1</u>
↓	40 ml glass	Purgeables ✓	Chill to 4°C	<u>POS-2</u>
↓	1 qt. glass	Metals, Phenols, Cyanide	Chill to 4°C	<u>MS 3</u>

Comments and additional observations: SAMPLE TAKEN NEKT TO INDUSTRIAL WASTE PIT SIGN. 8"-10" BELOW BOTTOM OF SURFACE WATER WAS HARD SURFACE (CONCRETE-LIKE). MUCH ROOTS & ORGANIC MATERIAL IN SEDIMENT, NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 12/16/83
Time: 0840

Sampling Site/Well No.: ELF4-17 SW
Sampling Location Description: ZONE I - LANDFILL 4
NORTH SIDE OF LANDFILL BETWEEN SLUDGE LAGOON
4-9

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @ _____

Surface Water and Sediment Samples

Total Depth 4-5"
Sample Depth(s) SURFACE
pH 6.4
Sp. cond. 1000 @ 8°C

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
<u>15237</u>	1 qt. glass	Oil & Grease	HCl to pH<4°C	_____
	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<4°C	<u>TP 310</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<4°C	<u>M 32</u> •
	8 oz. plastic	Mercury	HNO ₃ to pH<4°C	_____
	40 ml glass	TOX ✓	Chill to 4°C	<u>X61,62</u>
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 8</u> •
	40 ml glass	Purgeables	Chill to 4°C	_____
↓	1 qt. plastic	Cyanide ✓	NaOH to pH>12,4°C	<u>CN 14</u> •

Sediment Samples

_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: WATER COVERED WITH ALGAL SLIME & IRON BACTERIA FILM. BUILDING DEBRIS, PAINT CANS, ROTTING TREE TRUNKS & HEAVY LEAF LITTER ON BANKS & IN WATER.

ROBINS' AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: JWR/DPC
Date: 12/15/83
Time: 1650

Sampling Site/Well No.: LF4-18 (W-7 I LETCO, 1980)

Sampling Location Description: ZONE 1, W-7 LANDFILL 4
EXISTING WELL NEXT TO ABANDONED SHED.
(LAW ENGR.)

Groundwater Samples

Depth to water surface 3'10"

Surface Water and Sediment Samples

Total Depth _____

Height of water column _____

Sample Depth(s) _____

pH 4.3

pH _____

Sp. cond. 25 @ 18.5°C

Sp. cond. _____

<u>Sample No.</u>	<u>Container</u>	<u>Parameters to be Analyzed</u>	<u>Preservation Method</u>	<u>Container No.</u>
_____	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	_____
<u>TP 15238</u>	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2,4°C	<u>TP 17</u>
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2,4°C	<u>M37</u>
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	<u>X73,74</u>
_____	4 oz. plastic	DOC	HCl to pH <2	<u>TOC 10</u>
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide	NaOH to pH>12,4°C	<u>CN 1</u>

Sediment Samples

_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED*

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: JWR/DPC
Date: 12/15/83
Time: 1640

Sampling Site/Well No.: LF 4-19 (W-8 IN LETCO, 1980)
Sampling Location Description: ZONE 1, W-8 @ LANDFILL 4
LAW'S ENG. TEST WELL

Groundwater Samples

Depth to water surface 5' 3 $\frac{1}{2}$ "
Height of water column _____
pH 4.2
Sp. cond. 29 @ 16°C

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) _____
pH _____
Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	_____
<u>15239</u>	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2,4°C	<u>TP 18</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2,4°C	<u>M 39</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	_____
	40 ml glass	TOX ✓	Chill to 4°C	<u>X 75, 76</u>
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>DOC 14</u>
	40 ml glass	Purgeables	Chill to 4°C	_____
	1 qt. plastic	Cyanide ✓	NaOH to pH>12,4°C	<u>CNS</u>

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
	40 ml glass	Purgeables	Chill to 4°C	_____
	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: BAILED DRY @ ~15L
WATER SLIGHTLY TURBID, NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: JWR/DPC
Date: 12/16/83
Time: 1045

Sampling Site/Well No.: LF 4-20
Sampling Location Description: W-15, LAW ENG. TEST WELL
ON HANNAH RD.

Groundwater Samples

Depth to water surface 4' 9"

Height of water column _____

pH 4.8

Sp. cond. 24 @ 18

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
<u>15240</u>	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	_____
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	<u>TP 31</u>
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	<u>M 50</u>
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	_____
	40 ml glass	TOX	Chill to 4°C	<u>X 85, 86</u>
	4 oz. plastic	DOC	HCl to pH <2	<u>TOC 47</u>
	40 ml glass	Purgeables	Chill to 4°C	_____
↓	1 qt. plastic	Cyanide	NaOH to pH >12, 4°C	<u>CN 20</u>

Sediment Samples

_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED DRY @ 2 gal.
WATER TURBID, REDDISH-BRN., NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: JWR/DPC

Date: 12/16/83

Time: _____

Sampling Site/Well No.: LF4-21
Sampling Location Description: W-18, LAW ENG. TEST WELL

Groundwater Samples

Surface Water and Sediment Samples

Depth to water surface ?

Total Depth _____

Height of water column _____

Sample Depth(s) _____

pH 4.4

pH _____

Sp. cond. 16 @ 16.5°C

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
<u>15241</u>	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	<u>TP 27</u>
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	<u>M52</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
	40 ml glass	TOX	Chill to 4°C	<u>X67, 88</u>
	4 oz. plastic	DOC	HCl to pH<2	<u>TOC 39</u>
	40 ml glass	Purgeables	Chill to 4°C	_____
↓	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	<u>CN 23</u>
		Sediment Samples	<u>* REPLACES 87 (BROKEN)</u>	
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
	40 ml glass	Purgeables	Chill to 4°C	_____
	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED* gal. PRIOR TO
SAMPLING. WATER INITIALLY TURBID, BUT CLEARED
UP, NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

ter and Air Research, Inc.
21 S.W. Archer Road
O. Box 1121
Inesville, FL 32602
One: 904/372-1500

Sampled by: R03
Date: 12/16/83
Time: 0930

Sampling Site/Well No.: LEACHATE COMPOSITE ; LF4-22, 23, 24
Sampling Location Description: ZONE 1 - LANDFILL 4 ,
SOUTHERN SIDE OF LANDFILL

~~Groundwater Samples~~

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @ _____

Surface Water and Sediment Samples

Total Depth ~ 6 "
Sample Depth(s) SURFACE
pH 5.2
Sp. cond. 400 @ 10°C

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
<u>5242</u>	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	<u>CP2, 3</u>
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
	40 ml glass	TOX	Chill to 4°C	_____
	4 oz. plastic	DOC	HCl to pH <2	_____
↓	40 ml glass	Purgeables	Chill to 4°C	<u>PO 11, 22</u>
	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	_____

Sediment Samples

_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: SITE 1 - GULLY NEXT TO W-6;
WATER CLEAR, BUT CONTAINED MUCH IRON BACTERIA
SITE 2 & 3 - DEPRESSIONS IN OLD HAZARDOUS WASTE
DRUM BURIAL SITE. GRASSY BOTTOM, TADPOLES IN WATER.
WATER CLEAR AND PALE YELLOW. AREA SURROUNDED BY
I-22

ROBINS AFB FIELD SAMPLE SHEET

and Air Research, Inc.
S.W. Archer Road
Box 1121
Evansville, FL 32602
Tel: 904/372-1500

Sampled by: JLUR / DPC
Date: 12/16/83
Time: 1215

Sampling Site/Well No.: DOT - 1
Sampling Location Description: ZONE 2 - DOT SPILL SITE
10' WEST OF R.R. TRACK, BETWEEN CORP. OF ENG.
PARKING LOT FENCE & DITCH.

Groundwater Samples

Depth to water surface 43' 11 3/4"
Height of water column ~1'
pH 4.8
Sp. cond. 72 @ 18°C

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) _____
pH _____
Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
<u>1243</u>	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	<u>CP 4,5</u>
_____	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	_____
Sediment Samples				
_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	<u>CP 4,5</u>
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: ONLY 1 FT. OF WATER IN
WELL. SAMPLE TAKEN FROM 1ST RECHARGE WAS
OPAQUE, YELLOW-BRN.

AD-A157 887

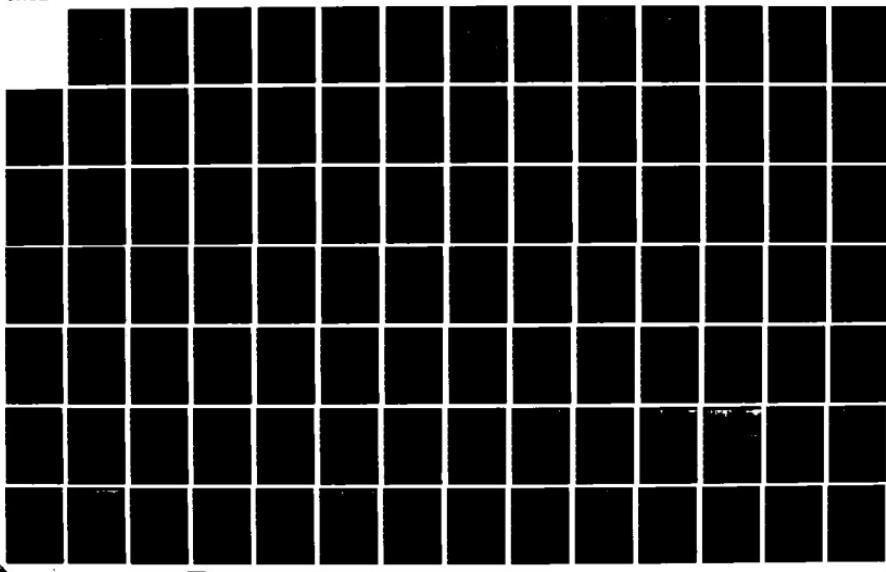
INSTALLATION RESTORATION PROGRAM PHASE
III--CONFIRMATION/QUANTIFICATION STAGE 1(U) WATER AND
AIR RESEARCH INC GAINESVILLE FL MAR 85

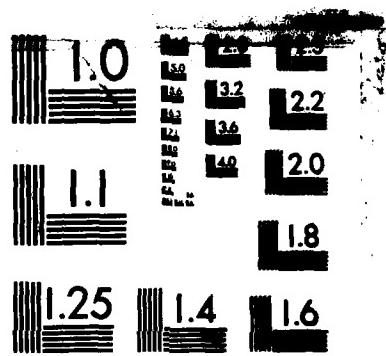
4/5

UNCLASSIFIED

F/G 13/2

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB
Date: 12/16/83
Time: 1205

Sampling Site/Well No.: DDT S-1 SOIL

Sampling Location Description: ZONE 2 - DDT SPILL SITE

ADJACENT TO OLD SPILL SITE, BETWEEN FENCE AROUND
PESTICIDE STORAGE AREA & CORP. OF ENG. PARKING LOT.

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH _____

Sp. cond. _____ @ _____

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) SURFACE TO 6"

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
_____	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	_____
Sediment Samples				
<u>15244</u>	1 qt. glass	Pesticides, PCBs	Chill to 4°C	<u>CPS-2</u>
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: TOPSOIL APPROX. 1-1/2"
THICK, RED-CLAY UNDERNEATH

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB
Date: 12/16/83
Time: 1215

Sampling Site/Well No.: DDT S-2 SOIL
Sampling Location Description: ZONE 2 - DDT SPILL
ADJACENT TO SE CORNER OF BLDG. 295

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @ _____

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) SURFACE TO 6"
pH _____
Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed Water Samples	Preservation Method	Container No.
_____	1 qt. glass	Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	_____
Sediment Samples				
<u>15245</u>	1 qt. glass	Pesticides, PCBs	Chill to 4°C	<u>CPS-3</u>
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: CRUSHED GRANITE WITH SANDY RED CLAY UNDERNEATH, ALSO BLACK-GREY TOPSOIL.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 12/16/83
Time: 1230

Sampling Site/Well No.: DDT S-3 SOIL
Sampling Location Description: DDT SPILL SITE - IN DITCH
WEST OF RAILROAD TRACKS, 20-30 NORTH OF WELL

~~Groundwater Samples~~

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) SURFACE TO 3"
pH _____
Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
_____	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	_____

Sediment Samples

<u>15246</u>	1 qt. glass	Pesticides, PCBs	Chill to 4°C	<u>CPS-4</u>
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: SANDY WET RED CLAY WITH
~½-1" OF OVERLYING MUSS, CRUSHED GRANITE

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 12/16/83
Time: 1240

Sampling Site/Well No.: DDT S-4 SOTL
Sampling Location Description: ZONE 2 - DDT SPILL SITE, IN
DITCH WEST OF R.R. TRACK, ~40-50' SOUTH OF WELL

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) SURFACE TO 4"
pH _____
Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
_____	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide	NaOH to pH >12, 4°C	_____

Sediment Samples

<u>15247</u>	1 qt. glass	Pesticides, PCBs	Chill to 4°C	<u>CPS-5</u>
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: SANDY, WET RED CLAY &
CRUSHED GRANITE

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDR/JWR/DPC
Date: 12/16/83
Time: 1420

Sampling Site/Well No.: FPT 2-1
Sampling Location Description: ZONE 3 - FIRE PROTECTION
TRAINING AREA #2

Groundwater Samples

Depth to water surface 8' 5 1/2"

Height of water column ~ 10'

pH 7.2

Sp. cond. 1140 @ 21°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH < 2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH < 2, 4°C	
15248	4 oz. plastic	Heavy Metals	HNO ₃ to pH < 2, 4°C	M428
	8 oz. plastic	Mercury	HNO ₃ to pH < 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	X89, 90
	4 oz. plastic	DOC	HCl to pH < 2	TOC X • 26
	40 ml glass	Purgeables	Chill to 4°C	PO28
	1 qt. plastic	Cyanide	NaOH to pH > 12, 4°C	

FILTERED
INTO
9 ↴

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: BAILED 10 gal. PRIOR TO
SAMPLING. WATER VERY HIGHLY SATURATED WITH
HEAVY, OILY MATERIAL (BLACK). ~ 1 FT. OF THIS
MATERIAL IN WELL CASING (PVC) WHICH COATED BAILER
& STRING. STRONG FUEL ODOR I-28

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB/JWR/OPC
Date: 12/16/83
Time: 1415

Sampling Site/Well No.: FPT 2-2
Sampling Location Description: ZONE 3 - FIRE PROTECTION
TRAINING AREA #2, NEXT TO DOG KENNEL IN PINE
TREES

Groundwater Samples

Depth to water surface 8' 10" *

Height of water column _____

pH 11.6

Sp. cond. 780 @ 25°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	<u>35</u> <i>REMOVED</i>
<u>15249</u>	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	<u>M 35</u> <i>REMOVED</i>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	<u>93 94</u>
	40 ml glass	TOX	Chill to 4°C	<u>X 35</u> <i>REMOVED</i>
	4 oz. plastic	DOC	HCl to pH<2	<u>TOC 35</u> <i>REMOVED</i>
	40 ml glass	Purgeables	Chill to 4°C	<u>PO 3</u>
	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	

Sediment Samples

	Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: WELL DEVELOPED BY LAWS
ENG. ON 12/15/83 FOR 2 HRS. BAILED 100 GALLONS
VOLUME PRIOR TO SAMPLING. WATER EXTREMELY
TURBID & FOAMY, WITH GELATINOUS MATERIAL FLOATING
AT TOP. * PRIOR TO DEVELOPMENT

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: LDA/JLWR
Date: 1/6/84
Time: 1530

Sampling Site/Well No.: FPT2-2 RESAMPLE
Sampling Location Description: ZONE 3 - FIRE PROTECTION
TRAINING AREA #2

Groundwater Samples 1/7/84 Surface Water and Sediment Samples
 Depth to water surface ~ 32' Total Depth _____
 Height of water column ~ 54' Sample Depth(s) _____
 pH FIELD 9.8; LAB 9.8 pH _____
 Sp. cond. 114 @ 25°C Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
_____	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2,4°C	_____
<u>15290</u>	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2,4°C	<u>M444</u>
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	_____
_____	40 ml glass	TOX ✓	Chill to 4°C	<u>X91,92</u>
_____	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 44</u>
_____	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO 18</u>
_____	1 qt. plastic	Cyanide	NaOH to pH>12,4°C	_____
Sediment Samples				
_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: WATER PINKISH-TAN FROM TURBIDITY DUE TO RED CLAY (?). BAILED 5 WELL VOLUMES PRIOR TO SAMPLING.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB/JWR/DPC
Date: 12/16/83
Time: 1330

Sampling Site/Well No.: ████████ or FPT 32-3
Sampling Location Description: ZONE 3, WS-11

Groundwater Samples

Depth to water surface ████████Height of water column ████████
SAMPLEpH ████████ NO SAMPLESp. cond. ████████ @

Surface Water and Sediment Samples

Total Depth ████████Sample Depth(s) ████████pH ████████Sp. cond. ████████

<u>Sample No.</u>	<u>Container</u>	<u>Parameters to be Analyzed</u>	<u>Preservation Method</u>	<u>Container No.</u>
████████	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	████████
████████	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	████████
████████	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2,4°C	████████
████████	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2,4°C	████████
████████	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	████████
████████	40 ml glass	TOX	Chill to 4°C	████████
████████	4 oz. plastic	DOC	HCl to pH <2	████████
████████	40 ml glass	Purgeables	Chill to 4°C	████████
████████	1 qt. plastic	Cyanide	NaOH to pH 12,4°C	████████
Sediment Samples				
████████	1 qt. glass	Pesticides, PCBs	Chill to 4°C	████████
████████	40 ml glass	Purgeables	Chill to 4°C	████████
████████	1 qt. glass	Metals	Chill to 4°C	████████

Comments and additional observations: OBSTRUCTION AT WATER SURFACE, 28' CASING █████ LOOSE IN HOLE, WELL OPEN FOR UNDETERMINED PERIOD OF TIME, NO PUMP PRESENT. WATER IN HOLE AROUND CASING, ~4' TD WATER SURFACE.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 12/15/83
Time: 1530

Sampling Site/Well No.: FPT 2-4
Sampling Location Description: ZONE 3, WS-12
WELL SUPPLYING LUNA LAKE

Groundwater Samples

Surface Water and Sediment Samples

Depth to water surface _____

Total Depth _____

Height of water column _____

Sample Depth(s) _____

pH 3.6 meter, 5.5 test strip pH _____Sp. cond. 39 e 18°C Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
<u>15250</u>	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	<u>TP 16</u>
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	<u>M 53</u>
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	<u>X 55, 56</u>
	4 oz. plastic	DOC	HCl to pH < 2	<u>TOC 37</u>
	40 ml glass	Purgeables	Chill to 4°C	<u>PO 6</u>
<u>V</u>	1 qt. plastic	Cyanide	NaOH to pH > 12, 4°C	<u>CN 13</u>

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: WATER CLEAR, NO ODOR.
SAMPLE TAKEN FROM 2½ - 3" ~~IRON PIPE~~ IRON PIPE
FLOWING @ ~ ~~\$500~~ GPM.

200

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB/JWR
Date: 12/13/83
Time: 1505

Sampling Site/Well No.: LF 1 - 1
Sampling Location Description: ZONE 4 - LANDFILL 1
WELL CLOSEST TO FUEL TRUCK PARKING LOT

Groundwater Samples

Depth to water surface 8' 3 $\frac{1}{2}$ "

Height of water column ~12'

pH 5.5

Sp. cond. 130 @ 19°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
<u>15251</u>	1 qt. glass	Oil & Grease ✓	HCl to pH<2, 4°C	<u>OG 1</u> -
	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2, 4°C	<u>TP 37</u> -
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2, 4°C	<u>M23</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
	40 ml glass	TOX ✓	Chill to 4°C	<u>X1, 2</u>
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 33</u>
	40 ml glass	Purgeables	Chill to 4°C	_____
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN 30</u> -

Sediment Samples

	Pesticides, PCBs	Chill to 4°C	_____
	Purgeables	Chill to 4°C	_____
	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED SOL BEFORE SAMPLING. WATER TURBID, MILKY WHITE-YELLOW, NO ODOR

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB/JWR
Date: 12/13/83
Time: 1600

Sampling Site/Well No.: LF 1-2
Sampling Location Description: ZONE 4 - LANDFILL 1
MIDDLE WELL IN LINE

Groundwater Samples

Depth to water surface 7' 7"

Height of water column ~ 7'

pH 5.4

Sp. cond. 80 @ 17.5°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
<u>15252</u>	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	<u>OG 2-</u>
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	<u>TP 40-</u>
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	<u>M 42</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	<u>X 56</u>
	4 oz. plastic	DOC	HCl to pH <2	<u>TOC 2i</u>
	40 ml glass	Purgeables	Chill to 4°C	<u>P 05</u>
	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	<u>CN 41-</u>

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: PUMPED SOL BEFORE
SAMPLING. WATER SAME AS LF1-1.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB/JW
Date: 12/13/83
Time: 1620

Sampling Site/Well No.: LF 1 - 3
Sampling Location Description: ZONE 4 - LANDFILL 1
WELL CLOSEST TO DITCH BETWEEN LF 1 & 2

Groundwater Samples

Depth to water surface 8' 8 1/2"
Height of water column ~ 11'
pH 5.3
Sp. cond. 120 @ 19.5°C

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) _____
pH _____
Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
<u>15253</u>	1 qt. glass	Oil & Grease ✓	HCl to pH<2, 4°C	<u>OG 3</u> -
	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2, 4°C	<u>TP 41</u> -
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2, 4°C	<u>M 43</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
	40 ml glass	TOX ✓	Chill to 4°C	<u>X 7 8</u>
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 12</u>
<u>15271</u>	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO 2</u> , 8
↓	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN 25</u> -

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
	40 ml glass	Purgeables	Chill to 4°C	_____
	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED SOL BEFORE SAMPLING. FUEL LAYER & STRONG ODOR, OTHERWISE SAME AS PREVIOUS 2 WELLS.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB/DPC/CRF
Date: 3/15/84
Time: 1630

Sampling Site/Well No.: LF4-1

Sampling Location Description: HANNAH RD.

Groundwater Samples

12/84 Depth to water surface 1' 10"

Height of water column _____

pH 5.0

Sp. cond. 27 @ 20.5

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	CN-5

Sediment Samples

	1 qt. glass	* Pesticides, PCBs	Chill to 4°C
	40 ml glass	Purgeables	Chill to 4°C
	1 qt. glass	Metals	Chill to 4°C

Comments and additional observations: PUMPED 100 gal. BEFORE
SAMPLING. WATER CLEAR, NO ODOR.

* ORGANOCHLORINE, ORGANOPHOSPHATE, HERBICIDES

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB/JWR
Date: 12/14/83
Time: 1030

Sampling Site/Well No.: R 7H~~10~~8 - 3
Sampling Location Description: WS - 8, IN S.A.C. AREA

Groundwater Samples

Depth to water surface _____

Total Depth _____

Height of water column _____

Sample Depth(s) _____

pH _____

pH _____

Sp. cond. _____ @ _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
<u>15265</u>	1 qt. glass	Water Samples Pesticides, PCBs, <u>Priority Pollutants</u> *	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2, 4°C	<u>TP 2</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2, 4°C	<u>M 17</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 20</u>
	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO 1</u>
↓	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN 42</u>

PEST 1

Sediment Samples

_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: WELL PUMPING SINCE
7:30 AM @ 800-900 GAL/MIN.

* PRIORITY POLLUTANT SAMPLE COMPOSITED WITH WATER
FROM OTHER WATER SUPPLY WELLS.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 12/15/83
Time: 1500

Sampling Site/Well No.: R7-32
Sampling Location Description: WS 6

Groundwater Samples

Depth to water surface _____

Surface Water and Sediment Samples

Total Depth _____

Height of water column _____

Sample Depth(s) _____

pH 6.5

pH _____

Sp. cond. 88 @ 17.5°C

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants*	Chill to 4°C	
, 15270, 15277	1 qt. glass	Oil & Grease	HCl to pH<4°C	
	4 oz. plastic	Phenols Ø	H ₂ SO ₄ to pH<4°C	TP 13, 14, 15
	8 oz. plastic	Heavy Metals Ø	HNO ₃ to pH<4°C	M 24, 55, 49
	40 ml glass	Mercury	HNO ₃ to pH<4°C	
	4 oz. plastic	TOX Ø	Chill to 4°C	X51, 52, 53, 54
	40 ml glass	DOC Ø	HCl to pH <2	TOC 7, 49
	1 qt. plastic	Purgeables ✓	Chill to 4°C	PO 21
↓ 15277	1 qt. plastic	Cyanide Ø	NaOH to pH>12, 4°C	CN 9, 10, 19

Sediment Samples

1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
40 ml glass	Purgeables	Chill to 4°C	_____
1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPING FOR 4 HRS. @
1700 GPM. PAINT FUMES IN SAMPLE AREA.

*PRIORITY POLLUTANT SAMPLES COMPOUNDED WITH WATER
FROM OTHER WATER SUPPLY WELLS.

MARCH 1984 SAMPLING

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RAB/SWR/DPC
Date: 12/13/83
Time: 1345

Sampling Site/Well No.: R 7 - 1
Sampling Location Description: WS W-3

Groundwater Samples

Depth to water surface _____

Total Depth _____

Height of water column _____

Sample Depth(s) _____

pH 5.0

pH _____

Sp. cond. 18 @ 19°C

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
_____	1 qt. glass	Water Samples Pesticides, PCBs, <u>Priority Pollutants*</u>	Chill to 4°C	_____
15263	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
_____	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2, 4°C	<u>TP 39</u> -
_____	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2, 4°C	<u>WR M 46</u>
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 41</u>
_____	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO 4</u>
↓	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN 27</u> -

Sediment Samples

_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PLUMPING SINCE 9 AM,
SAMPLED FROM FAUCET COMING OFF 8-10" MAIN
* PRIORITY POLLUTANT SAMPLE COMPOSITED WITH
WATER FROM OTHER WATER SUPPLY WELLS.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB / DPC
Date: 12/16/83
Time: 1345

Sampling Site/Well No.: HW-1
Sampling Location Description: ZONE G - HAZARDOUS WASTE
BURIAL SITE, NEXT TO FIRING RANGE.

Groundwater Samples

Depth to water surface 27' 11 $\frac{1}{4}$ "

Height of water column ~ 7'

pH 4.8

Sp. cond. 24 @ 19°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
<u>15262</u>	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	<u>CP 6, 7</u>
↓ 15	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	<u>HG 1, 2, M310</u>
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	_____
Sediment Samples				
_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	<u>CP 6, 7</u>
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: BAILED 10 gal. PRIOR TO
SAMPLING. WATER TURSID, YELLOW-BRN. PILES
OF LEAF & GRASS CLIPPINGS (TRUCK LOADS) ADJACENT
TO WELL, PUNGENT SWEET CAMPHOR-LIKE ODOR.

1-44
.05T OF TURBIDITY SETTLED QUICKLY INTO ~ 1/2" - 1" OF SEDIMENT.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: R03/JWR
Date: 12/14/83
Time: 0930

Sampling Site/Well No.: LF2-6 SW

Sampling Location Description: ZONE 5, LANDFILL 2
SURFACE WATER NE OF LF2-1

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH _____

Sp. cond. _____ @ _____

Surface Water and Sediment Samples

Total Depth 18 - 24"

Sample Depth(s) SURFACE

pH 6.3

Sp. cond. 158 @ 16°C

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
_____	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	_____
<u>15261</u>	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2,4°C	<u>IPL</u>
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2,4°C	<u>MIS -</u>
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	<u>X23,24</u>
_____	4 oz. plastic	DOC	HCl to pH <2	<u>TOC 31 -</u>
_____	40 ml glass	Purgeables	Chill to 4°C	<u>PO 20</u>
_____	1 qt. plastic	Cyanide	NaOH to pH>12,4°C	<u>CN 46</u>

Sediment Samples

_____	Pesticides, PCBs	Chill to 4°C	_____
_____	Purgeables	Chill to 4°C	_____
_____	Metals	Chill to 4°C	_____

Comments and additional observations: WIDE STREAM FROM DOUBLE CULVERT UNDER RD. BANKS ~~WER~~ & BED OF STREAM REIN CLAY WITH WILLOWS & BRIARS GROWING ON THEM. WATER TURBID, PALE YELLOW.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 12/14/83
Time: 0745

Sampling Site/Well No.: LF2-5 SW

Sampling Location Description: ZONE 5 LANDFILL 2
SURFACE WATER BETWEEN LF2-3 & LF2-2

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH _____

Sp. cond. _____ @

Surface Water and Sediment Samples

Total Depth 3-4"

Sample Depth(s) SURFACE

pH 6.8

Sp. cond. 510 @ 11°C

(498 on x1)

Preservation Method

Container No.

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
_____	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	_____
15260, 15269, 15276	1 qt. glass	Phenols Ø	H ₂ SO ₄ to pH<2,4°C	TP 45, 46, 47
↓	4 oz. plastic	Heavy Metals Ø	HNO ₃ to pH<2,4°C	M20, 27, 34
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	_____
_____	40 ml glass	TOX Ø	Chill to 4°C	X15, 16, 17, 18
_____	4 oz. plastic	DOC Ø	HCl to pH <2	TOC 25, 29
_____	40 ml glass	Purgeables ✓	Chill to 4°C	PO 17
↓ 15276	1 qt. plastic	Cyanide Ø	NaOH to pH>12,4°C	CN 32, 33, 34

Sediment Samples

_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PLUMBED SOIL BEFORE
SAMPLING. STREAM BED & SIDES VERY ROCKY,
WILLOW TREES & SCRUB VEGETATION, CLEAR WATER
& NO ODOR. SAMPLES TAKEN APPROX. 10 FT. FROM
CULVERT UNDER RD., SOUTH SIDE.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB/JWR
Date: 12/13/83
Time: 1530

Sampling Site/Well No.: LF2 ~~10~~ - 4 SW
Sampling Location Description: ZONE 5 - SURFACE WATER,
AT CONFLUENCE OF RUNWAY DRAINAGE DITCH
AND DITCH BORDERING LANDFILL

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @

Surface Water and Sediment Samples
Total Depth 8-12"
Sample Depth(s) SURFACE
pH 6.1
Sp. cond. 71 @ 16.5°C

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
<u>15259</u>	1 qt. glass	Oil & Grease ✓	HCl to pH<2, 4°C	
	4 oz. plastic	Phenols ✓	H ₂ SO ₄ to pH<2, 4°C	<u>TP 38-</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2, 4°C	<u>M 26</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX ✓	Chill to 4°C	<u>X 3, 4</u>
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 45</u>
	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO 13</u>
↓	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>BB 26 -</u> <u>CN</u>
		Sediment Samples		
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: WATER CLEAR WITH OCCASIONAL PATCHES OF OILY-LOOKING ~~WHITE~~ FILM.
STRONG CHEMICAL/FUEL ODOR NEAR DITCH.
BOTTOM SANDY, WITH RED CLAY SILT FROM DITCH BORDERING ^{LANDFILL}, NO MACROFAUNA PRESENT.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB/JWR
Date: 12/14/83
Time: 0745

Sampling Site/Well No.: LF 2-3
Sampling Location Description: ZONE 5 - LANDFILL 2
ACROSS DITCH FROM RD.

Groundwater Samples

Depth to water surface 7' 8 1/2"

Height of water column ~ 22

pH 5.2

Sp. cond. 93 @ 17°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
<u>15258</u>	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH<2,4°C	<u>TP 44</u>
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH<2,4°C	<u>M 19</u> -
	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	
	40 ml glass	TOX ✓	Chill to 4°C	<u>X 13, 14</u>
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 1</u> -
	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO 15</u>
	1 qt. plastic	Cyanide ✓	NaOH to pH>12,4°C	<u>CN 36</u>
Sediment Samples				
	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: OVERCAST, SCATTERED SHOWERS,
~50-55°F. PUMPED SOL BEFORE SAMPLING,
WATER SLIGHTLY TURBID, LT. YELLOW-BRN.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB/JWR
Date: 12/14/83
Time: 0850

Sampling Site/Well No.: LF2-2

Sampling Location Description: ZONE 5 - LANDFILL 2,
MIDDLE WELL IN LINE, 10 YDS. FROM ROAD ON
SHOULDER.

Groundwater Samples

Depth to water surface 8' 10"

Height of water column ~ 21'

pH 5.0

Sp. cond. 71 e 16°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	
<u>15257</u>	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	<u>TP 48</u>
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	<u>M 28-</u>
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	<u>X 19, 20</u>
	4 oz. plastic	DOC	HCl to pH < 2	<u>TOC 11</u>
	40 ml glass	Purgeables	Chill to 4°C	<u>POS-1</u>
	1 qt. plastic	Cyanide	NaOH to pH 12, 4°C	<u>CN 45</u>

Sediment Samples

	Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: PUMPED SOL BEFORE
SAMPLING. WATER SAME AS Z-1.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB/JWR
Date: 12/14/83
Time: 0920

Sampling Site/Well No.: LF2-81
Sampling Location Description: LANDFILL NO. 2 - ZONE 5
ON SHOULDER OF RD.

Groundwater Samples

Depth to water surface 9'5½"

Height of water column ~ 20'

pH 5.6

Sp. cond. 325 @ 19.5°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
<u>15256</u>	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	<u>TP 11</u>
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	<u>M 22</u>
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	<u>X 21, 22</u>
	4 oz. plastic	DOC	HCl to pH <2	<u>TOC 51</u>
	40 ml glass	Purgeables	Chill to 4°C	<u>PO 14</u>
	1 qt. plastic	Cyanide	NaOH to pH 12, 4°C	<u>CN 37</u>

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: PLUMPED SOL BEFORE
SAMPLING. WATER MORE TURBID THAN PREVIOUS
2 WELLS THIS SITE, YELLOW-BRN.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDG/JWR/OPC
Date: 12/13/83
Time: 1720

Sampling Site/Well No.: LF 1-5
Sampling Location Description: ZONE 4 - LANDFILL 1
WELL FURTHEREST FROM RD., CLOSE TO TREES

Groundwater Samples

Depth to water surface 2' 5"
Height of water column ~ 14'
pH 5.4
Sp. cond. 112 @ 18.5°C

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) _____
pH _____
Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
<u>15255</u> , <u>15268</u>	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	<u>OG 5,6</u> -
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	<u>TP 43</u> -
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	<u>M 54</u>
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	<u>XIL,12</u>
	4 oz. plastic	DOC	HCl to pH 2	<u>TOC 46</u>
	40 ml glass	Purgeables	Chill to 4°C	
↓	1 qt. plastic	Cyanide	NaOH to pH 12, 4°C	<u>CN 28</u> -

Sediment Samples

	1 qt. glass	Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: PUMPED 25L BEFORE THIS
40
SAMPLING. WATER TURBID, REDDISH-
BRN., SEPTIC ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDS/JWR/DPC
Date: 12/13/83
Time: 1700

Sampling Site/Well No.: LF1-4
Sampling Location Description: ZONE 4 - LANDFILL 1

Groundwater Samples

Depth to water surface 2' 3½"
Height of water column ~ 13'
pH 6.0
Sp. cond. 790 @ 21°C

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) _____
pH _____
Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	
<u>15254</u>	1 qt. glass	Oil & Grease ✓	HCl to pH 2, 4°C	<u>OG 4</u> ^
	1 qt. glass	Phenols ✓	H ₂ SO ₄ to pH 2, 4°C	<u>TP 42</u> ^
	4 oz. plastic	Heavy Metals ✓	HNO ₃ to pH 2, 4°C	<u>M21</u>
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX ✓	Chill to 4°C	<u>X9, 10</u>
	4 oz. plastic	DOC ✓	HCl to pH <2	<u>TOC 2</u>
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH 12, 4°C	<u>CN 43</u> ^

Sediment Samples

	Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: PUMPED 35L BEFORE SAMPLING (DRY). WATER TURBID, SANDY-GREY, NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RAB/DPC/CRF
Date: 3/15/84
Time: 1635

Sampling Site/Well No.: LF 4-2
Sampling Location Description: HANNAH RD.

Groundwater Samples

3/12/84 Depth to water surface 4' 1"

Height of water column _____

pH 5.1

Sp. cond. 24 @ 19.5°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
_____	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2,4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2,4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables ✓	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide ✓	NaOH to pH>12,4°C	<u>CN-14</u>
Sediment Samples				
_____	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED 50 gal. BEFORE
SAMPLING WATER SAME AS 4-1

* ORGANOCHLORINE, ORGANOPHOSPHATE, HERBICIDES

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MPT / RDB
Date: 3/16/84
Time: 1455

Sampling Site/Well No.: LF 4-3

Sampling Location Description: SLUDGE LAGOON - WEST

Groundwater Samples

3/12/84 Depth to water surface 7'5"

Height of water column _____

pH 5.6

Sp. cond. 41 @ 23 °C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2,4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2,4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH>12,4°C	<u>CN-34</u>

Sediment Samples

	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: PUMPED 50 gal. BEFORE SAMPLING.

* ORGANOCHLORINE, ORGANOPHOSPHATE, HERBICIDES

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB / MPT
Date: 3/16/84
Time: 1430

Sampling Site/Well No.: LF4-4

Sampling Location Description: SLUDGE LAGOON - WEST

Groundwater Samples

3/12/84 Depth to water surface 7' 6 1/4"

Height of water column _____

pH 5.4

Sp. cond. 125 @ 23.5°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH<2	
	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO-19</u>
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN-49</u>

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: PUMPED 20 gal. BEFORE SAMPLING. SOLVENT, ORGANIC VAPOR ODOR. WATER SLIGHTLY TURBID.

ROBINS AFB FIELD SAMPLE SHEET

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P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MPT/ROB
Date: 3/16/84
Time: 1350

Sampling Site/Well No.: LF 4-5Sampling Location Description: SLUDGE LAGOON - EAST

Groundwater Samples

3/12/84 Depth to water surface 6' 5 3/4"

Height of water column _____

pH 4.4Sp. cond. 26 @ 24°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH 12, 4°C	<u>CN-12</u>

Sediment Samples

	1 qt. glass	* Pesticides, PCBs	Chill to 4°C
	40 ml glass	Purgeables	Chill to 4°C
	1 qt. glass	Metals	Chill to 4°C

Comments and additional observations: PUMPED 50 gal. BEFORE SAMPLING. WATER CLEAR, SMALLAYER OF IRON BACTERIA,

ROBINS AFB FIELD SAMPLE SHEET

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6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MPT / RDB
Date: 3/16/84
Time: 1450

Sampling Site/Well No.: LF 4 - G

Sampling Location Description: SLUDGE LAGOON - EAST

Groundwater Samples

3/12/84 Depth to water surface 6' 10 3/4"

Height of water column _____

pH 5.1

Sp. cond. 343 @ 22°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH<2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	

15444

PO-21

PD-22

CN-50

1547

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: PUMPED 18 gal. BEFORE SAMPLING. WATER TURBID, VERY FOAMY (WHITE) WITH VAPOR COMING OFF PUMP EFFLUENT. SAMPLERS WORE ORGANIC VAPOR MASKS.

* ORGANOCHLORINE, ORGANIC SPHATATE, HERBICIDES

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MPT/RDB
Date: 3/16/89
Time: 1030

Sampling Site/Well No.: LF 4-7

Sampling Location Description: LANDFILL EASTERN BOUNDARY,
NORTHERN GROUP OF WELLS

Groundwater Samples

3/12/84 Depth to water surface 2' 10"

Height of water column _____

pH 5.8

Sp. cond. 2.9 @ 21°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	LOC	HCl to pH < 2	
	40 ml glass	Purgeables. ✓	Chill to 4°C	PO-28
	1 qt. plastic	Cyanide ✓	NaOH to pH > 12, 4°C	CN-11, CN-40, CN-27, sp. ke, 200 ml, 366 mg/ml KCl
		Sediment Samples		
	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: PLUMPED 25 gal. BEFORE
SAMPLING. WATER SLIGHTLY TURBID, NO ODOR.

15473

* ORGANOCHLORINE, ORGANOPHOSPHATE, HERBICIDES

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MPT/RDB
Date: 3/16/84
Time: 1015

Sampling Site/Well No.: LF 4 - 8

Sampling Location Description: LANDFILL EASTERN BOUNDARY,
NORTHERN GROUP OF WELLS

Groundwater Samples

3/12/84 Depth to water surface 3' 3 5/8"

Height of water column _____

pH 5.6

Sp. cond. 32 @ 21

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	P029
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	CN 43

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C
	Purgeables	Chill to 4°C
	Metals	Chill to 4°C

Comments and additional observations: PUMPED 62 gal BEFORE
SAMPLING. WATER CLEAR, NO ODOUR.

ROBINS AFB FIELD SAMPLE SHEET

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Sampled by: MPT/ROB
Date: 3/16/84
Time: 1050

Sampling Site/Well No.: LF 4 - 9

Sampling Location Description: LANDFILL EASTERN BOUNDARY,
NORTHERN GROUP OF WELLS

Groundwater Samples

3/12/84 Depth to water surface 5' 6 3/4"

Height of water column _____

pH 5.1

Sp. cond. 50 @ 25°

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed Water Samples	Preservation Method	Container No.
_____	1 qt. glass	* Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH < 2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH < 2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH < 2, 4°C	15447
_____	8 oz. plastic	Mercury	HNO ₃ to pH < 2, 4°C	#1
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH < 2	_____
_____	40 ml glass	Purgeables ✓	Chill to 4°C	P-30
_____	1 qt. plastic	Cyanide ✓	NaOH to pH > 12, 4°C	CN-27

Sediment Samples

_____	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED 100 gal. BEFORE
SAMPLING. WATER CLEAR, NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

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6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MPT/ROB
Date: 3/16/83
Time: 0940

Sampling Site/Well No.: LF 4 - 10
Sampling Location Description: LANDFILL EASTERN BOUNDARY

Groundwater Samples

3/12/83 Depth to water surface 3' 5 1/8"

Height of water column _____

pH 5.7

Sp. cond. 27 @ 19.5°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
_____	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables ✓	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide ✓	NaOH to pH >12, 4°C	<u>CN 37</u>

Sediment Samples

_____	* Pesticides, PCBs	Chill to 4°C	_____
_____	Purgeables	Chill to 4°C	_____
_____	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED 21 gal. BEFORE
SAMPLING. WATER CLEAR, H₂S ODOR.

ROBINS AFB FIELD SAMPLE SHEET

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Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MPT/RDS
Date: 3/16/84
Time: 0925

Sampling Site/Well No.: LF4-11

Sampling Location Description: LANDFILL EASTERN BOUNDARY

Groundwater Samples

3/12/84 Depth to water surface 4' 4 3/8"

Surface Water and Sediment Samples

Total Depth _____

Height of water column _____

Sample Depth(s) _____

pH 5.1

pH _____

Sp. cond. 28 @ 18.5°C

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN 16</u>
Sediment Samples				
	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

154415

Comments and additional observations: PLUMPED 61 gal. BEFORE
SAMPLING. WATER CLEAR, NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

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6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MPT/RDS
Date: 3/16/84
Time: 0945

Sampling Site/Well No.: LF 4-12

Sampling Location Description: LANDFILL EASTERN BOUNDARY

Groundwater Samples

1/12/84 Depth to water surface 4' 7 1/4"

Height of water column _____

pH 5.2

Sp. cond. 35 @ 19°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables	✓ Chill to 4°C	
	1 qt. plastic	Cyanide	✓ NaOH to pH>12, 4°C	CN 4

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C
	Purgeables	Chill to 4°C
	Metals	Chill to 4°C

Comments and additional observations: PUMPED 100 gal. BEFORE SAMPLING. WATER CLEAR, NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: WDA/DPCDate: 16 MAR 83Time: 1057Sampling Site/Well No.: LF 4-13Sampling Location Description: UPGRADIENT WELL FOR LF-4.

Groundwater Samples

Depth to water surface 38' 9 1/8"2/51 Height of water column ~ 61 FTpH 8.4Sp. cond. 40 @ 19°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

<u>Sample No.</u>	<u>Container</u>	<u>Parameters to be Analyzed</u>	<u>Preservation Method</u>	<u>Container No.</u>
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO-7</u>
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN-13</u>

<u>Sediment Samples</u>			
	1 qt. glass	* Pesticides, PCBs	Chill to 4°C
	40 ml glass	Purgeables	Chill to 4°C
	1 qt. glass	Metals	Chill to 4°C

Comments and additional observations: PUMPED 61+ GAL = 1500
SLB Pump. WATER CLEAR ODORLESS.

ROBINS AFB FIELD SAMPLE SHEET

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6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 3/16/84
Time: 0930

Sampling Site/Well No.: LF 4-14 SW & SED.
Sampling Location Description: ADJACENT TO (NORTH) WELL
GROUP LF4-10, 11, 12

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @

Surface Water and Sediment Samples

Total Depth 4-6 "
Sample Depth(s) SURFACE
pH 6.5
Sp. cond. 1550 (at) 15 °C

<u>Sample No.</u>	<u>Container</u>	<u>Parameters to be Analyzed</u>	<u>Preservation Method</u>	<u>Container No.</u>
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN 46</u>

15452

Sediment Samples				
	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals Cyanide	Chill to 4°C	<u>S-1</u>

15453

Comments and additional observations: THICK ALGAL SCUM, IRON BACTERIA & VISIBLE SHEEN. NO MACROFAUNA.
LEAF MOLD VERY THICK ALSO.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RJB
Date: 3/16/84
Time: 1035

Sampling Site/Well No.: LF4-15 SW & SED
Sampling Location Description: ADJACENT TO (NORTH) ~~OF~~ WELL
GROUP LF4-7, 8, 9

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @

Surface Water and Sediment Samples

Total Depth 4-6 "
Sample Depth(s) SURFACE
pH 6.10
Sp. cond. 1380 @ 14

<u>Sample No.</u>	<u>Container</u>	<u>Parameters to be Analyzed</u>	<u>Preservation Method</u>	<u>Container No.</u>
_____	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables ✓	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide ✓	NaOH to pH >12, 4°C	<u>CN-38</u>

Sediment Samples

_____	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals Cyanide	Chill to 4°C	<u>S-2</u>

1545415455

Comments and additional observations: WATER TURBID, MUCH IRON
BACTERIA, ORGANIC DEBRIS ON BOTTOM, SOME
ALGAE.

I-62

* ORGANOCHLORINE, ORGANOPHOSPHATE, HERBICIDES

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: WDA/DPCDate: 16 MAR 84Time: 1530Sampling Site/Well No.: FPT 2-2Sampling Location Description: LUNA LAKE F.P.T.

Groundwater Samples

Depth to water surface _____

Surface Water and Sediment Samples

Total Depth _____

Height of water column ~ 53 FT

Sample Depth(s) _____

pH 5.7

pH _____

Sp. cond. 8.9 @ 22.5°C

Sp. cond. _____

<u>Sample No.</u>	<u>Container</u>	<u>Parameters to be Analyzed</u>	<u>Preservation Method</u>	<u>Container No.</u>
_____	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO-15</u>
_____	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	_____

Sediment Samples

_____	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED ~ 53 GAL. WATER
CLEAR, THEN TURNED PINK. NO ODOUR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: DPC/WDA
Date: 16 MAR 84
Time: 1837

Sampling Site/Well No.: FPT 2-1 FPT 2-1

Sampling Location Description: LUNA LAKE, NEAR DOG KENNEL

Groundwater Samples

Depth to water surface N.T.

Height of water column ~ 15 FT

pH 5.8

Sp. cond. 1,000 @ 18°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	PO-31
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C
	Purgeables	Chill to 4°C
	Metals	Chill to 4°C

Comments and additional observations: THICK OIL LAYER ON
WATER SURFACE. BAILED 15 GAL FROM WELL. WATER
PHASE SL. TURBED, ORANGE. FUEL OR SOLVENT ODOR.

* ORGANOCHLORINE, ORGANOPHOSPHATE, HERBICIDES

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 3/16/84
Time: 1745

Sampling Site/Well No.: DDT - S4

Sampling Location Description: _____

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH _____

Sp. cond. @ _____

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) SURFACE

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH 12, 4°C	

Sediment Samples

	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	<u>S9</u>
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: _____

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDS
Date: 3/16/84
Time: 1740

Sampling Site/Well No.: DDT-53

Sampling Location Description: _____

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH _____

Sp. cond. _____ @ _____

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) SURFACE

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	<u>S8</u>
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: _____

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB
Date: 3/16/84
Time: 1735

Sampling Site/Well No.: DDT - S2
Sampling Location Description: _____

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH _____

Sp. cond. _____ @ _____

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) SURFACE

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, Priority Pollutants	✓ Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables	✓ Chill to 4°C	
	1 qt. plastic	Cyanide	✓ NaOH to pH>12, 4°C	

15483

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	<u>S6</u>
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: _____

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 3/16/84
Time: 1730

Sampling Site/Well No.: DDT - 51

Sampling Location Description: _____

~~Groundwater Samples~~

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) SURFACE
pH _____
Sp. cond. _____

<u>Sample No.</u>	<u>Container</u>	<u>Parameters to be Analyzed</u>	<u>Preservation Method</u>	<u>Container No.</u>
_____	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables ✓	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	_____

Sediment Samples

_____	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	<u>55</u>
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: _____

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MT
Date: 3/16/84
Time: 1730

Sampling Site/Well No.: PDT-1
Sampling Location Description: _____

Groundwater Samples

Depth to water surface _____

Surface Water and Sediment Samples

Total Depth _____

Height of water column _____

Sample Depth(s) _____

pH 4.7

pH _____

Sp. cond. 82 @ 20.5

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
_____	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	C.P.-6
_____	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables ✓	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	_____

Sediment Samples

_____	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: APPROX. 5 FT. OF WATER IN WELL. BAILED ~1.5 L BEFORE SAMPLING.
WATER TURBID, REDDISH-ORANGE.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB

Date: 15 MAR 84

Time: 1845

Sampling Site/Well No.: LCH COMP. - LF4-22, 23, 24

Sampling Location Description: _____

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH _____

Sp. cond. _____ @

Surface Water and Sediment Samples

Total Depth 4 TO 8 INCHES

Sample Depth(s) SURFACE

pH 8.4

Sp. cond. 49 umhos/cm @ 20°C

<u>Sample No.</u>	<u>Container</u>	<u>Parameters to be Analyzed</u>	<u>Preservation Method</u>	<u>Container No.</u>
_____	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	<u>CP-1, CP-2, HB-1</u>
_____	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO-9</u>
_____	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	_____
Sediment Samples				
_____	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: _____

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB / DPC / CEF

Date: 3/15/84

Time: _____

Sampling Site/Well No.: LF 4-21 (W-18)

Sampling Location Description: HANNAH RD. EXISTING WELL

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH 4.3

Sp. cond. 21 @ 19.5°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN - 21</u>

15461

Sediment Samples

	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: PUMPED 35 gal. BEFORE SAMPLING. CLEAR, CLOUDY (TURBID) ORANGE, CLEAR LAYERS IN WELL.

ROBINS AFB FIELD SAMPLE SHEET

WDBA

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDR/DPC/CRF
Date: 3/15/84 3/16/84
Time: 1619

Sampling Site/Well No.: LF 4-20 (W-15)
Sampling Location Description: HANNAH RD. EXISTING WELL

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH 5.7 5.8 3/16Sp. cond. 26 33 22 22 °C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	3/15 <i>not enough</i> <i>distilled</i>
	1 qt. plastic	Cyanide ✓	NaOH to pH >12, 4°C	CA-18 SCN-22
		Sediment Samples		3/16/84
	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: PLUMPED DRY @ 0.5 gal.READ pH & SP. COND. ON ~ 250 mL OF TURBID, ORANGE.15 min: 1917 1 WELL VOL. || 16 MAR: 0900 - 3RD W.V.; 1352-4TH W.V.1619: 5TH W.V. # SAMPLE WATER CLEAR, ODORLESS.* ORGANOCHLORINE, ORGANIC I-67 HATE, HERBICIDES

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: DPC/MPT/RDB
Date: 3/16/84
Time: 1135

Sampling Site/Well No.: LF4-19 (W-8)
Sampling Location Description: LANDFILL 4 EXISTING WELL

Groundwater Samples

Depth to water surface _____

Height of water column _____

pH 7.0Sp. cond. 20 @ 18.5°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH >12, 4°C	<u>CN-17</u>

15460

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

(TOTAL)

Comments and additional observations: PUMPED & BATLED 11 gal. ON
2 DAYS. WATER VERY TURBID, GREY-BRN.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MPT / WOA
Date: 15 MAR 84
Time: 1840

Sampling Site/Well No.: LF 4-18 (W-7)
Sampling Location Description: LANDFILL 4 EXISTING WELL

Groundwater Samples

Depth to water surface _____

Height of water column ~ 47 FTpH 4.8Sp. cond. 28 pμho/ @ 20.5°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH 12, 4°C	<u>CN-25</u>

15451

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: PUMPED 50+ GAL. WATER
CLEAR, ODORLESS.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB/MAT
Date: 3/16/84
Time: 1045

Sampling Site/Well No.: LF 4-17 SW
Sampling Location Description: NORTH BOUNDARY OF LANDFILL,
BETWEEN SLUDGE LAGOON & LF4-15.

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @ _____

Surface Water and Sediment Samples

Total Depth 2 - 4 "
Sample Depth(s) SURFACE
pH 6.7
Sp. cond. 1395 @ 19°C

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
_____	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	✓ Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables ✓	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN-39</u>
Sediment Samples				
_____	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

15458

Comments and additional observations: THICK ALGAL SCUM, IRON
BACTERIA, LEAF MOULD.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 3/16/84
Time: 1300

Sampling Site/Well No.: LF 4-16 SW & SED
Sampling Location Description: ADJACENT TO SLUDGE LAGOON

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @

Surface Water and Sediment Samples

Total Depth 8-12"
Sample Depth(s) SURFACE
pH 6.4
Sp. cond. 120 (\leftrightarrow) 23.5^{\circ}\text{C}

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	(CP-4/CP-5/HB-2)
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	(CN-31) (CN-44), CN-48 → 15470
		Sediment Samples		
	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	S-4 → 15470
	40 ml glass	Purgeables	Chill to 4°C	PO-20 → 15470
	1 qt. glass	Metals Cyanide	Chill to 4°C	S-3 → 15475

Comments and additional observations: APPEARANCE SAME AS IN
DESC -

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: DPC / WDA
Date: 16 MAR 84
Time: 1553

Sampling Site/Well No.: WS-12 (FPT 2-4)
Sampling Location Description: WATER SUPPLY FOR LUNA LAKE

Groundwater Samples

Depth to water surface N.T.Height of water column N.T.pH 4.1Sp. cond. 47 @ 23.5°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2,4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2,4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	PO-16
	1 qt. plastic	Cyanide ✓	NaOH to pH>12,4°C	CN-9

15480

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: PURGED WELL. WATER CLEAR.
ODORLESS.

DRAFT FOR REVIEW ONLY

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: WDA / MPT

Date: 15 MAR 84

Time: 1648

Sampling Site/Well No.: LF 1 - 1

Sampling Location Description: WELL NEAREST FUEL TRUCK
PARKING AREA

Groundwater Samples

3/12/84 Depth to water surface 7' 4 1/2"

Height of water column ~13 FT

pH 5.2

Sp. cond. 91 @ 20°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
<u>15426</u> <u>15426</u>	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN-45</u>
Sediment Samples				
	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

15426

Comments and additional observations: PUMPED 13 GAL +, WATER
WHITE, TURBED, FAINT ODOR

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: WDA/MPT
Date: 15 MAR 84
Time: 1701

Sampling Site/Well No.: LF 1-2
Sampling Location Description: MIDDLE WELL IN GROUP

Groundwater Samples

3/12/84 Depth to water surface 6' 10 1/4"
Height of water column ~ 3 FT
pH 5.5
Sp. cond. 75 @ 17°C

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) _____
pH _____
Sp. cond. _____

1542-7

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
<u>15427</u>	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO-10</u>
↓	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN-52</u>

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: PUMPED ~ 10 GAL. WATER
WHITE, TURBED, FAINT FUEL ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: WDA / MPT

Date: 15 MAR 84

Time: 1725

Sampling Site/Well No.: LF 1 - 3

Sampling Location Description: EASTERN WELL

Groundwater Samples

3/12/84 Depth to water surface 6' 10 3/4"

Height of water column ~ 13 FT

pH 5.5

Sp. cond. 75 @ 16°C

Surface Water and Sediment Samples

Total Depth

Sample Depth(s)

pH

Sp. cond.

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	15428
	1 qt. glass	Oil & Grease	HCl to pH < 2, 4°C	15431
	1 qt. glass	Phenols	H ₂ SO ₄ to pH < 2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH < 2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH < 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH < 2	
	40 ml glass	Purgeables ✓	Chill to 4°C	PO-11, PO-17, 3-22
	1 qt. plastic	Cyanide ✓	NaOH to pH > 12, 4°C	CN-32, CN-47, CN-41
Sediment Samples				
	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

→ Spiked with
50µl of
366 µg/ml
TKCN
CRF

Comments and additional observations: PUMPED 13+ GAL. WATER WHITE,
TURBED, FUEL ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MPT / DPC
Date: 3/15/84
Time: 1445

Sampling Site/Well No.: LF 1 - 4
Sampling Location Description: _____

Groundwater Samples

3/12/84 Depth to water surface 2'5"

Height of water column _____

pH 6.2

Sp. cond. 1310 @ 21°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	15429
	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH < 2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH > 12, 4°C	CN-10

Sediment Samples

	1 qt. glass	* Pesticides, PCBs	Chill to 4°C
	40 ml glass	Purgeables	Chill to 4°C
	1 qt. glass	Metals	Chill to 4°C

Comments and additional observations: BAILED DRY @ 10 gal.
WATER VERY TURBID, GREY-BRN., FOAMY.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MPT / DPC
Date: 3/15/84
Time: 1430

Sampling Site/Well No.: LF 1-5
Sampling Location Description: ADJACENT TO WTP

Groundwater Samples

16 1/4" FROM ^{PVC} Surface Water and Sediment Samples

Depth to water surface 24 3/8 FROM ~~CASING~~ Total Depth

Height of water column _____ Sample Depth(s) _____

pH 5.9 pH _____

Sp. cond. 123 @ 24°C Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	15430
	1 qt. glass	Oil & Grease	HCl to pH<2,4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2,4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2,4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2,4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	
	1 qt. plastic	Cyanide ✓	NaOH to pH>12,4°C	CN-26

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C
	Purgeables	Chill to 4°C
	Metals	Chill to 4°C

Comments and additional observations: PUMPED 15 gal. BEFORE
SAMPLING. WATER TURBID, YELLOW-BRN.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: MPT / OPC
Date: 3/15/84
Time: 1535

Sampling Site/Well No.: LF 2-1

Sampling Location Description: _____

Groundwater Samples

3/12/84 Depth to water surface 8' 9"

Height of water column _____

pH 5.8

Sp. cond. 590 @ 21.5°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	_____
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
	40 ml glass	TOX	Chill to 4°C	_____
	4 oz. plastic	DOC	HCl to pH <2	_____
	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO-4</u>
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN-1</u>

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	_____
	Purgeables	Chill to 4°C	_____
	Metals	Chill to 4°C	_____

Comments and additional observations: PUMPED 21 gal. BEFORE
SAMPLING. WATER TURBID, YELLOW-ORANGE, INITIAL
FUEL ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: CRF
Date: 3/15/84
Time: 1530

Sampling Site/Well No.: LF 2-2

Sampling Location Description: _____

Groundwater Samples

3/12/84 Depth to water surface 8' 1 1/2"

Height of water column _____

pH 5.2

Sp. cond. 110 @ 21.5

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables	✓ Chill to 4°C	<u>PO-5</u>
	1 qt. plastic	Cyanide	✓ NaOH to pH>12, 4°C	<u>CN-15</u>

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: PUMPED 21 gal. BEFORE SAMPLING. WATER TURRID, BUT NO COLOR. H₂S ODOR, NO VISIBLE SNEFLI

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: CRF
Date: 3/15/84
Time: 1435

Sampling Site/Well No.: LF2-3

Sampling Location Description: _____

Groundwater Samples

1/12/84 Depth to water surface 6' 11 1/2"

Height of water column _____

pH 6.2

Sp. cond. 127 @ 23°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	<u>PO-3</u>
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	<u>CN-24</u>

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: PUMPED 22 gal. BEFORE SAMPLING. WATER CLEAR, BUT ORANGE FLOCULENT MATERIAL PRESENT WHICH APPEARED TO BE HYDROPHOBIC. NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: EP 3/15/84
Time: 1720

Sampling Site/Well No.: LF 2-4 SW
Sampling Location Description: JUNCTION OF DITCH DRAINING
RUNWAY AREA & DITCH BORDERING LANDFILL 1

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @

Surface Water and Sediment Samples

Total Depth 4 - 6 "
Sample Depth(s) SURFACE
pH 6.1
Sp. cond. 102 @ 20°C

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	15434
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH < 2	
	40 ml glass	Purgeables ✓	Chill to 4°C	PO-12
	1 qt. plastic	Cyanide ✓	NaOH to pH 12, 4°C	CN-30
Sediment Samples				
	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: WATER CLEAR & FLOWING.
GREEN ALGAE ON BANKS, NO MACROFAUNA.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: ROB
Date: 3/15/84
Time: 1415

Sampling Site/Well No.: LF2-5 SW
Sampling Location Description: CULVERT BETWEEN LF2-3 & LF2-2

~~Groundwater Samples~~

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @ _____

Surface Water and Sediment Samples

Total Depth 3 - 4 "
Sample Depth(s) SURFACE
pH 7.2
Sp. cond. 805 @ 23 °C

<u>Sample No.</u>	<u>Container</u>	<u>Parameters to be Analyzed</u>	<u>Preservation Method</u>	<u>Container No.</u>
_____	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	_____
_____	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	15437
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables ✓	Chill to 4°C	PO-2
_____	1 qt. plastic	Cyanide ✓	NaOH to pH 12, 4°C	CN-2
Sediment Samples				
_____	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: WATER CLEAR & FLOWING,
BROWN ALGAE ON BOTTOM AND PLANTS. NO ODOR OR
VISIBLE FILM ON SURFACE.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: RDB
Date: 3/15/84
Time: 1425

Sampling Site/Well No.: LF 2-6 SW
Sampling Location Description: EASTERNMOST CULVERT, SECOND ST.

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @

Surface Water and Sediment Samples

Total Depth ~ 12 "
Sample Depth(s) SURFACE
pH 6.5
Sp. cond. 153 @ 24°C

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, Priority Pollutants	✓ Chill to 4°C	
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables	✓ Chill to 4°C	<u>PO-1</u>
	1 qt. plastic	Cyanide	✓ NaOH to pH>12, 4°C	<u>CN-8</u>
Sediment Samples				
	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: WATER CLEAR & SLUGGISH FLOW. BROWN & GREEN ALGAE PRESENT ON BANKS & STICKS IN STREAM. NO ODOR, VISIBLE SHEEN, OR MACROFAUNA.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: WDA/DPC
Date: 16 MAR 84
Time: 1730

Sampling Site/Well No.: H4-1

Sampling Location Description: NEAR PESTOL RANGE

Groundwater Samples

Depth to water surface 27' 0 1/8"

Height of water column ~ 8 FT

pH 4.1

Sp. cond. #31 @ 21.5

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	DDT CP-3, CP-8
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	_____
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	15481
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
	40 ml glass	TOX	Chill to 4°C	_____
	4 oz. plastic	DOC	HCl to pH <2	_____
	40 ml glass	Purgeables ✓	Chill to 4°C	_____
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	_____

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	_____
	Purgeables	Chill to 4°C	_____
	Metals	Chill to 4°C	_____

Comments and additional observations: BOTTLED 5 WELL VOL.

WATER TURBED, ORANGE, NO ODOR.

ROBINS AFB FIELD SAMPLE SHEET

Later and Air Research, Inc.
1821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: WDA/DPC

Date: 16 MAR 84

Time: 1124

Sampling Site/Well No.: WS - 3

Sampling Location Description: WATER SUPPLY WELL #3. BY FUEL FARM

Groundwater Samples

Depth to water surface N.T.

Height of water column N.T.

pH 6.0

Sp. cond. 69 @ 19°C

Surface Water and Sediment Samples

Total Depth

Sample Depth(s)

pH

Sp. cond.

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	D-69 <i>with composite</i>
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	54
	4 oz. plastic	DOC	HCl to pH <2	14565
	40 ml glass	Purgeables ✓	Chill to 4°C	15466
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	PO-8, PO-18, CN-28, CN-3, CN-19, 5467
		Sediment Samples		→ spike 5 gal of 366 mg/l of KCN
	1 qt. glass	* Pesticides, PCBs	Chill to 4°C	
	40 ml glass	Purgeables	Chill to 4°C	
	1 qt. glass	Metals	Chill to 4°C	

Comments and additional observations: TOOK 1 GAL FOR PRI POL COMPOSITE. PUMPED WELL BEFORE SAMPLING.

Water and Air Research, Inc.
8821 S.W. Archer Road
P.O. Box T121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

7166-100

SAMPLERS: (Signature)

W.A.R., INC.

Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
			Water	Air	Sediment		
	12/17/83		X			15221	VOLATILE
						223	AROMATICS
						224	
						225	VOLATILE
						226	HALOCARBONS
						230	
						235	
						236	
						242	
						248	
						249	
						250	
						252	
						253	
						256	

Received by: Don Chansler

on: WAR

Received by: J. X. (Acana)

Organization: TSI

Date/Time

12/17/83 2:00

Received by:

on:

Received by:

Organization:

Date/Time

Received by:

on:

Received by:

Organization:

Date/Time

Received by:

on:

Received by:

Organization:

Date/Time

Received for Laboratory by:

Date/Time

Shipment:

C.C.

Water and Air Research, Inc.

6821 S.W. Archer Road

P.O. Box 1121

Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

			SAMPLERS: (Signature)				
T: 7166-100			W. A. R., INC.				
Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
			Water	Air	Sediment		
	12/17/82		X			15259	Total
						15260	Cyanide
						1	
						3	
						4	
						5	
						6	
						7	
						9	
						15270	
						2	
						5	
						6	
						7	
Issued by: Dan Chamberlin Action: W.A.R.			Received by: G. Macanay Organization: TS1			Date/Time 12/17/82 85 2:00	
Issued by: Action:			Received by: Organization:			Date/Time	
Issued by: Action:			Received by: Organization:			Date/Time	
Issued by: Action:			Received by: Organization:			Date/Time	
Issued by: Action:			Received for Laboratory by:			Date/Time	
Method of Shipment: C.C.							

Air Samples Preserved
12/17/82 by W.A.R.

Water and Air Research Inc.
5821 SW. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

WT: 366-100
ECT:

SAMPLERS: (Signature)

W.A.R., INC.

Order	Station Location	Date	Time	Sample Type and No.			WAR Sample No.:	Analysis Required
				Water	Air	Sediment		
13		12/14/83		X			15218	TOTAL
16							9	CYANIDE
6							15220	
12							1	
3	30H						2	
7	REMOVED						3	
39							4	
22							5	
38	SAMPLE 12						6	
35							7	
47	AL 9						8	
40	AL 10						9	
8							15230	
26								
2							2	

Quashed by: Don Chamberlain

Organization: W.A.R.

Received by: E. Macanay

Organization: TS1

Date/Time

12/15/83 10:00

Quashed by:

Organization:

Received by:

Organization:

Date/Time

Quashed by:

Organization:

Received by:

Organization:

Date/Time

Quashed by:

Organization:

Received by:

Organization:

Date/Time

Quashed by:

Organization:

Received for Laboratory by:

Date/Time

Mode of Shipment:

C.C.

Water and Air Research, Inc.
 6821 S.W. Archer Road
 P.O. Box 1121
 Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

NT: 7166-100
 IECT:

SAMPLERS: (Signature)

W.A.R., INC.

In xer	Station Location	Date	Time	Sample Type and No.			WAR Sample No... 15235	Analysis Required TOTAL
				Water	Air	Sediment		
17	12/19/83			X				
14					1			7 CYANIDE
1								8
5								9
20							15240	
23								
13	12/19/83 in Wadsworth						15250	
30								1
41								2
25								3
43								4
28	All 5 min. 12/19/83							5
37								6
45								7
36								8

Iquished by: Dan Chambali
 nization: W.A.R.

Received by: B. Placanay
 Organization: TSI

Date/Time
12-19
53 ~00

Iquished by:
 nization:

Received by:
 Organization:

Date/Time

Iquished by:
 nization:

Received by:
 Organization:

Date/Time

Iquished by:
 nization:

Received by:
 Organization:

Date/Time

Iquished by:
 nization:

Received for Laboratory by:

Date/Time

od of Shipment: C.C.

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

T: 7166-100
CT:

SAMPLERS: (Signature)

W.A.R INC.

uished by: Dan Chanski zation: W.A.Z.	Received by: G. Lacanay Organization: TSI	Date/Time 11/13/2000
uished by: zation:	Received by: Organization:	Date/Time
uished by: zation:	Received by: Organization:	Date/Time
uished by: zation:	Received by: Organization:	Date/Time
uished by: zation:	Received for Laboratory by:	Date/Time

Water and Air Research, Inc.

6821 S.W. Archer Road

P.O. Box 1121

Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

NT:

ECT: 7166-100

SAMPLERS: (Signature)

WAR Inc.

Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.,	Analysis Required
				Water	Air	Sediment		
1						x	15233	
2						1	15234	bio to bio *
3							15236	
1							15236	Pesticides
2							15244	DDT
3							15245	DDT
4							15246	DDT
5						w	15247	DDT

* { Ni, Cu, Pb, Zn, Cr, Cd, }
 { Phosphates, CN, less ignition @ 550 °C }

Quashed by: Don Chansler

Organization: W.A.R.

Received by: Bo. Xlacanay

Organization: TSI

Date/Time

12-19
83 | 2000

Quashed by:

Organization:

Received by:

Organization:

Date/Time

Quashed by:

Organization:

Received by:

Organization:

Date/Time

Quashed by:

Organization:

Received by:

Organization:

Date/Time

Quashed by:

Organization:

Received for Laboratory by:

Date/Time

Mode of Shipment:

C.C.



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

ENT: 7166-100
JECT:

SAMPLERS: (Signature)

W.A.R., INC.

Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
		Water	Air	Sediment		
7.20	12/20/83	X			15257	TOX
7.14					8	
7.4					9	
7.16					15260	
7.24		"	"		1	
7.58					6	
7.28					7	
7.18		↓	↓		9	↓

Inquished by: Robert D. Barker, Jr. Organization: W.A.R., INC. 12/20/83	Received by: Rand Potter Organization: USTC	Date/Time 12/21/83 10:00 AM
Inquished by: Organization:	Received by: Organization:	Date/Time
Inquished by: Organization:	Received by: Organization:	Date/Time
Inquished by: Organization:	Received by: Organization:	Date/Time
Inquished by: Organization:	Received for Laboratory by:	Date/Time



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: PROJECT: 7166-100				SAMPLERS: (Signature) W.A.R., INC.				
Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
				Water	Air	Sediment		
77,78		12/20/83		X			15235	TOX
1,62							7	
23,74							8	
25,76							9	
15,86							15240	
7,87							1	
9,90							8	
13,94							9	
15,56							15250	
1,2							1	
5,6							2	
7,8							3	
9,10							4	
11,12							5	
21,22		↓		↓			6	↓
Abandoned by:	Robert A. Baker, Jr.	Received by:	Rand Pitter	Date/Time				
Organization:	W.A.R. W.A.R., INC.	Organization:	URTC	12/20/83	10:00 AM			
Abandoned by:	12/20/83	Received by:		Date/Time				
Organization:		Organization:						
Abandoned by:		Received by:		Date/Time				
Organization:		Organization:						
Abandoned by:		Received by:		Date/Time				
Organization:		Organization:						
Abandoned by:		Received for Laboratory by:		Date/Time				
Organization:								
Method of Shipment:	FED. EXPRESS							



WATER & AIR RESEARCH, INC.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT:

PROJECT: 7166-100

SAMPLERS: (Signature)

W.A.R., INC.

Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
				Water	Air	Sediment		
X81, 82		12/20/83		X			15218	TOX
* 84							9	
47, 48							15220	
49, 50							1	
45, 46							2	
43, 44							3	
37, 38							4	
39, 40							5	
35, 36							6	
31, 32							7	
29, 30							8	
25, 26							15229	15250
27, 80							15230	
33, 34							1	
41, 42		Y					2	V

Relinquished by: Robert J. Baker Jr.
Organization: W.A.R., INC. 12/20/83

Received by: Rand Potter

Date/Time
12/21/83 10:00 AM

Relinquished by:

Organization:

Received by:

Organization:

Date/Time

Relinquished by:

Organization:

Received by:

Organization:

Date/Time

Relinquished by:

Organization:

Received by:

Organization:

Date/Time

Relinquished by:

Organization:

Received for Laboratory by:

Date/Time

Method of Shipment: FED. EXPRESS

* 1 VIAL BROKEN IN LOG-IN

DECEMBER 1983 SAMPLING

APPENDIX J
CHAIN OF CUSTODY FORMS

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: WDA / DPC / RDE / CRF
Date: 3/17/84
Time: 0730

Sampling Site/Well No.: COMPOSITE OF WS-3, 6 & 8

Sampling Location Description: FOR PRIORITY POLLUTANTS
(114 ORGANIC COMPOUNDS)

Groundwater Samples

Depth to water surface _____
Height of water column _____
pH _____
Sp. cond. _____ @ _____

Surface Water and Sediment Samples

Total Depth _____
Sample Depth(s) _____
pH _____
Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
<u>15486</u>	1 qt. glass	Water Samples Pesticides, PCBs, Priority Pollutants	Chill to 4°C	<u>P0-23, CP-9, CP-10</u>
_____	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	<u>CP-11, CP-12, D-69</u>
_____	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	_____
_____	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	_____
_____	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	_____
_____	40 ml glass	TOX	Chill to 4°C	_____
_____	4 oz. plastic	DOC	HCl to pH <2	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. plastic	Cyanide	NaOH to pH>12, 4°C	_____
Sediment Samples				
_____	1 qt. glass	Pesticides, PCBs	Chill to 4°C	_____
_____	40 ml glass	Purgeables	Chill to 4°C	_____
_____	1 qt. glass	Metals	Chill to 4°C	_____

Comments and additional observations: COMPOSITED AFTER SAMPLES
WERE CHILLED, BUT WITHIN 24 HRS. OF COLLECTION.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: WDA/DPCDate: 16 MAR 84Time: 1147Sampling Site/Well No.: WS-8Sampling Location Description: WATER SUPPLY WELL IN SAC AREA

Groundwater Samples

Depth to water surface N.T.Height of water column N.T.pH 8.4Sp. cond. 110 @ 16.5°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	D-68
	1 qt. glass	Oil & Grease	HCl to pH 2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH 2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH 2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH 2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH <2	
	40 ml glass	Purgeables ✓	Chill to 4°C	PO-13
	1 qt. plastic	Cyanide ✓	NaOH to pH >12, 4°C	CN-7

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C
	Purgeables	Chill to 4°C
	Metals	Chill to 4°C

Comments and additional observations: WELL ON LANE. WATER CLEAR,
ODORLESS. TOOK 1 GAL FOR COMPOSITE.

ROBINS AFB FIELD SAMPLE SHEET

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, FL 32602
Phone: 904/372-1500

Sampled by: WDA/DPT
Date: 16 MAR 84
Time: 1241

Sampling Site/Well No.: WS-6

Sampling Location Description: WATER SUPPLY WELL IN HOUSING

Groundwater Samples

Depth to water surface N.T.

Height of water column N.T.

pH 5.8

Sp. cond. 38 @ 11°C

Surface Water and Sediment Samples

Total Depth _____

Sample Depth(s) _____

pH _____

Sp. cond. _____

Sample No.	Container	Parameters to be Analyzed	Preservation Method	Container No.
	1 qt. glass	* Water Samples Pesticides, PCBs, ✓ Priority Pollutants	Chill to 4°C	D-71
	1 qt. glass	Oil & Grease	HCl to pH<2, 4°C	
	1 qt. glass	Phenols	H ₂ SO ₄ to pH<2, 4°C	
	4 oz. plastic	Heavy Metals	HNO ₃ to pH<2, 4°C	
	8 oz. plastic	Mercury	HNO ₃ to pH<2, 4°C	
	40 ml glass	TOX	Chill to 4°C	
	4 oz. plastic	DOC	HCl to pH<2	
	40 ml glass	Purgeables ✓	Chill to 4°C	PO-14
	1 qt. plastic	Cyanide ✓	NaOH to pH>12, 4°C	CN-23

water sample
composite

15471

Sediment Samples

	* Pesticides, PCBs	Chill to 4°C	
	Purgeables	Chill to 4°C	
	Metals	Chill to 4°C	

Comments and additional observations: PURGED WELL. WATER CLEAR
& ODORLESS. Took 1 GAL FOR PRD Pol Compos.



Water and Air Research, Inc.
 6821 S.W. Archer Road
 P.O. Box 1121
 Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: PROJECT: 7166 - 100				SAMPLERS: (Signature) W. A. R., INC.				
Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
				Water	Air	Sediment		
P05-1		12/12/83		X			15257	VOLATILE
P0 15							258	AROMATICS
13							259	
17							260	VOLATILE
20							261	HALOCARBONS
5							263	
21							264	
1							265	
8							271	
25							274	
P05-2							X 15236	
Relinquished by: Dan Chanski Organization: WAR				Received by: L. Xlacañay Organization: TSI			Date/Time 12/12/83 2:00	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received for Laboratory by:			Date/Time	
Method of Shipment: C.C.								



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: PROJECT:	7166-100			SAMPLERS: (Signature)		
Station Number	Station Location	Date	Time	Sample Type and No.	W.A.R. Sample No.	Analysis Required
M4		12/19/83		X Water	15235	Nickel,
32				Air	78	copper,
37	O			Sediment	8	lead,
39	0				9	Zinc,
50	5 7 3				15240	chromium,
52	5 7 3					cadmium
9	FILTRATION				8	Lead only
35	U CONC				9	
53	sample				15250	
23	5 6 7				1	Nickel,
42	4 6 7				2	Copper
43	4 6 7				3	lead, zinc
21	2 5 6				4	chromium
545	F 2				5	cadmium
228					6	
Relinquished by: Dan Chastain		Received by: E. Massey		Date/Time		
Organization: W.A.R. Inc.		Organization: TSI		12-19 83 2000		
Relinquished by:		Received by:		Date/Time		
Organization:		Organization:				
Relinquished by:		Received by:		Date/Time		
Organization:		Organization:				
Relinquished by:		Received by:		Date/Time		
Organization:		Organization:				
Relinquished by:		Received for Laboratory by:		Date/Time		
Organization:						
Method of Shipment: C.C.						



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: PROJECT: 7166-100				SAMPLERS: (Signature) W.A.R., INC.				
Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
				Water	Air	Sediment		
1141		12/19/95		X			15218	Nickel,
33							9	Copper
2							15220	Lead,
3							1	Zinc,
7							2	Chromium,
1							3	Cadmium
13							4	
8							5	
12							6	
25							7	
14							8	
16							9	
40							15230	
6							1	
5							2	
Relinquished by: Dan Chambali Organization: Water Air Research				Received by: G. X (Signature) Organization: TS1			Date/Time 12/19/95 2000	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received for Laboratory by:			Date/Time	
Method of Shipment: C.C.								



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: PROJECT: 7166-100				SAMPLERS: (Signature) W.A.R., INC.				
Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No...	Analysis Required
				Water	Air	Sediment		
1123		12/14/83		X			15257	Nickel
19							8	Copper
26							9	Lead, Zinc
26	FILTER HNU						15260	chromium
15	FILTER HNU						15261	cadmium
46	FILTER CONC						15263	
24	FILTER CONC						15264	
17	SAMPLE CONC						15265	
51	SAMPLE CONC						6	
18	ALL PRESERVED						7	
27	ALL PRESERVED						9	
55	THRU PRESERVED	↓		↓			15270	
111	ALL PRESERVED	12/14/83		X			15272	
1124	ALL PRESERVED	↓		↓			15276	
Relinquished by: Dan Chamberlin Organization: W.A.R.				Received by: E. X. Lacanay Organization: TSI				Date/Time 12-14 83 2000
Relinquished by: Organization:				Received by: Organization:				Date/Time
Relinquished by: Organization:				Received by: Organization:				Date/Time
Relinquished by: Organization:				Received by: Organization:				Date/Time
Relinquished by: Organization:				Received for Laboratory by:				Date/Time
Method of Shipment: C.C.								



Water and Air Research, Inc.
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Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: PROJECT:				SAMPLERS: (Signature) W.A.R., INC.				
Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
				Water	Air	Sediment		
HG 1		12/19/11		X			15262	Mercury
HG 2					X		15279	
M310							15280	
M49							15277	Ni, Cu, Pb, Zn
								Cr Cd
ALL SAMPLES FILTERED								
TAKEN 0.45 μm FILTERS								
PRESERVE & CONC. UND?								
Relinquished by: Dan Landerhi Organization: W.A.R.				Received by: G. Xlacaanay Organization: TSI			Date/Time 12-19-83 2000	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received for Laboratory by:			Date/Time	
Method of Shipment:								



Water and Air Research, Inc.
 6821 S.W. Archer Road
 P.O. Box 1121
 Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT:
 PROJECT:

7166 - 100

SAMPLERS: (Signature)

W.A.R. TTS

Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
				Water	Air	Sediment		
T1-26		12/19/83		X			15216	70711
T1-22							9	PLATEAU
T1-49							15220	(TP)
T1-70							1	
1							2	
2							3	
3							4	
12	ALL SAMPLES PRESERVED						5	
9	< 2 mm. Hg.						6	
7							7	
6							8	
5							9	
10							15232	
8							1	
3							2	6
Relinquished by: Dan Chansai Organization: W.A.R.				Received by: L. X. Acaray Organization: TSI			Date/Time 12-19 2000 83	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received by: Organization:			Date/Time	
Relinquished by: Organization:				Received for Laboratory by:			Date/Time	
Method of Shipment: C.C.								



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: 7166 - 100
PROJECT:

SAMPLERS: (Signature)

W.A.R. INC.

Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.,	Analysis Required
				Water	Air	Sediment		
TP 19		12/17/83		X			15239	TOTAL
310							7	100% ANALYSIS
17							3	
18							9	
21							15240	
22							1	
16							15250	
27							1	
43							2	
41							3	
42							4	
43							5	
11							6	
43							7	
44							8	

Relinquished by: Don Chamseli

Organization: W.A.R.

Received by: C. Macanay

Organization: TSI

Date/Time

12-19 83 2000

Relinquished by:

Organization:

Received by:

Organization:

Date/Time

Relinquished by:

Organization:

Received by:

Organization:

Date/Time

Relinquished by:

Organization:

Received by:

Organization:

Date/Time

Relinquished by:

Organization:

Received for Laboratory by:

Date/Time

Method of Shipment:



Water and Air Research, Inc.
 6821 S.W. Archer Road
 P.O. Box 1121
 Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

IENT: 7166 100
 OJECT:

SAMPLERS: (Signature)

W A R Jta

ition mber	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
				Water	Air	Sediment		
1		12/19/83		X			15260	TOTAL
2							15260	FUEL OIL
3							1	
4							2	
5							3	
6							4	
7							5	
8							6	
9							7	
10							8	
11							9	
12							10	
13							11	
14							12	
15							13	
16							14	
17							15	
18							16	
19							17	
20							18	
21							19	
22							20	
23							21	
24							22	
25							23	
26							24	
27							25	
28							26	
29							27	
30							28	
31							29	
32							30	
33							31	
34							32	
35							33	
36							34	
37							35	
38							36	
39							37	
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41							39	
42							40	
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45							43	
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61							59	
62							60	
63							61	
64							62	
65							63	
66							64	
67							65	
68							66	
69							67	
70							68	
71							69	
72							70	
73							71	
74							72	
75							73	
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79							77	
80							78	
81							79	
82							80	
83							81	
84							82	
85							83	
86							84	
87							85	
88							86	
89							87	
90							88	
91							89	
92							90	
93							91	
94							92	
95							93	
96							94	
97							95	
98							96	
99							97	
100							98	

elinquished by: Don Chamberlain
 ganization: W.A.R.

Received by: C. Macanay
 Organization: TSI

Date/Time
 12-19-83 2000

elinquished by:
 ganization:

Received by:
 Organization:

Date/Time

elinquished by:
 ganization:

Received by:
 Organization:

Date/Time

elinquished by:
 ganization:

Received by:
 Organization:

Date/Time

elinquished by:
 ganization:

Received for Laboratory by:

Date/Time

ethod of Shipment:



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

ENT: 7166 - 100
JECT:

SAMPLERS: (Signature)

W.A.R. 7166

ion nber	Station Location	Date	Time	Sample Type and No.			WAR Sample No.,	Analysis Required
				Water	Air	Sediment		
1		12/16/81		X			15216	DUC
2							7	
19							15226	
22							1	
23							2	
24							3	
17							4	
18							5	
19							6	
20							7	
21							8	
22							9	
23							15230	
43							1	
51							2	

Inquished by: Dan Chanske
anization: W.A.R.

Received by: Dr. X. Macanay
Organization: TS1

Date/Time
12-15
83 2030

Inquished by:
anization:

Received by:
Organization:

Date/Time

Inquished by:
anization:

Received by:
Organization:

Date/Time

Inquished by:
anization:

Received by:
Organization:

Date/Time

Inquished by:
anization:

Received for Laboratory by:

Date/Time

ethod of Shipment:

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

T: 7166 - 100
CT:

SAMPLERS: (Signature)

W.A.R., INC.

Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
			Water	Air	Sediment		
1	12/19/83		X			15235	DOC
2						7	
3						8	
4						9	
5						15240	
6						1	
7						8	
8						9	
9						15250	
10						1	
11						2	
12						3	
13						4	
14						5	
15						6	↓

Issued by: Dan Choussie
Station: W.A.R.

Received by: B. Xlacaanay
Organization: TSI

Date/Time
12/19/83 2000

Issued by:
Station:

Received by:
Organization:

Date/Time

Issued by:
Station:

Received by:
Organization:

Date/Time

Issued by:
Station:

Received by:
Organization:

Date/Time

Issued by:
Station:

Received for Laboratory by:

Date/Time

Point of Shipment: C.C.

Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

T: 7166-400
CT:

SAMPLERS: (Signature)

W.A.R., INC.

uished by: Dan Chombele zation: W. A. R.	Received by: B. K. Lacanay Organization: TSI	Date/Time 17-15 83 2000
uished by: zation:	Received by: Organization:	Date/Time
uished by: zation:	Received by: Organization:	Date/Time
uished by: zation:	Received by: Organization:	Date/Time
uished by: zation:	Received for Laboratory by:	Date/Time
Id of Shipment:		

MARCH 1984 SAMPLING

Vater and Air Research, Inc.
 821 S.W. Archer Road
 P.O. Box 1121
 Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

USAF ROBINS AFB			SAMPLERS: (Signature)				
Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
			Water	Air	Sediment		
	3/15		PO-10			15427	PURGEABLE ORGANICS
NOTE:			PO-11	(3 only)		15428	METHODS 601, 602
POLYL each *			PO-17			15431	
			PO-4			15433	
			PO-5			15434	
			PO-3			15435	
			PO-12			15436	
			PO-2			15437	
			PO-1			15438	
			PO-19			15442	
			PO-21			15444	
			PO-28			15445	
			PO-29			15446	
			PO-30			15447	
			PO-7			15451	
Entered by: Charles R. Bellows	Received by: Walter Mock	Date/Time					
In: WAFR	Organization: TSI	2/17/84 1335					
Entered by:	Received by:	Date/Time					
In:	Organization:						
Entered by:	Received by:	Date/Time					
In:	Organization:						
Entered by:	Received by:	Date/Time					
In:	Organization:						
Entered by:	Received for Laboratory by:	Date/Time					
In:							
Shipment: CO. COURIER							

Vater and Air Research, Inc.

821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32601

CHAIN OF CUSTODY RECORD

USAF

ROBINS AFB

SAMPLERS: (Signature)

Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
			Water	Air	Sediment		
	3/15		PO-32			15456	PURGEABLE ORGANICS
			*		PO-20	15457	METHODS 601, 602
			PO-9			15462	
TE:			FIELD BLANK			15463	
ml each *			PO-8			15465	
			PO-18			15466	
			PO-13			15468	
			PO-14			15471	
			PO-22			15472	
			PO-31			15478	
			PO-15			15479	
			PO-16			15480	

id by: n:	Received by: Organization:	Date/Time
d by: n:	Received by: Organization:	Date/Time
d by: n:	Received by: Organization:	Date/Time
d by: n:	Received by: Organization:	Date/Time
d by: n:	Received for Laboratory by:	Date/Time
Shipment:	CO. COURIER	

AD-A157 087

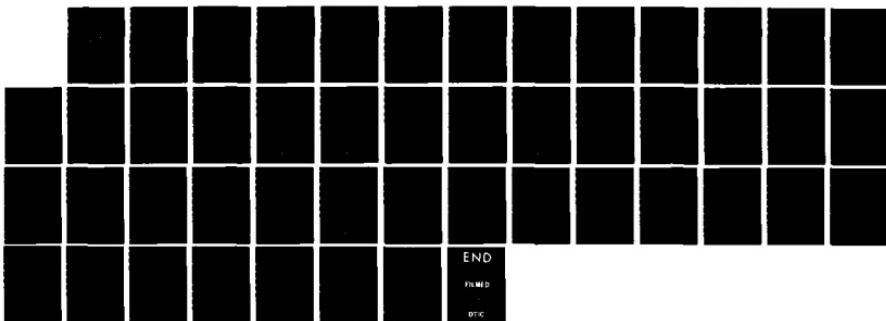
INSTALLATION RESTORATION PROGRAM PHASE
II--CONFIRMATION/QUANTIFICATION STAGE 1(U) WATER AND
AIR RESEARCH INC GAINESVILLE FL MAR 85

5/5

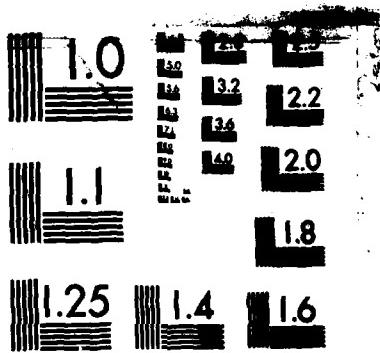
UNCLASSIFIED

F/G 13/2

NL



END
FILMED
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: USAF
PROJECT: ROBENS AFB

SAMPLERS: (Signature)

* BOTTLE S-4 WILL
BE USED FOR THREE
ANALYSES !

Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received by: Organization:	Date/Time
Relinquished by: Organization:	Received for Laboratory by:	Date/Time
Method of Shipment:	CO. COURIER	

Method of Shipment: CO. COURIER



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: USAF PROJECT: RUTSDEN & APB				SAMPLERS: (Signature)				
Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
				Water	Air	Sediment		
		3/15		CP-4			15456	CHLORINATED INSECTICIDES
					S-4*		15475 15457	↓
				CP-1			15462	↓
							15475	
				CP-6			15476 (INCLUDING CHLORDANE)	
					S-5	15482 (")		
					S-6	15483 (")		
					S-8	15484 (")		
					S-9	15485 (")		
				<p>* BOTTLE S-4 WILL BE USED FOR THREE ANALYSES.</p>				
Relinquished by: Organization:	Charles R. Johnson WAR	Received by: Organization:	Walter Mock TSI	Date/Time				
3/17/84 1335								
Relinquished by: Organization:		Received by: Organization:		Date/Time				
Relinquished by: Organization:		Received by: Organization:		Date/Time				
Relinquished by: Organization:		Received by: Organization:		Date/Time				
Relinquished by: Organization:		Received for Laboratory by:		Date/Time				
Method of Shipment:	Co. COURIER							



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: U.S.A.F.
PROJECT: ROBINS AFB

SAMPLERS: (Signature)

Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
				Water	Air	Sediment		
		3/15		CN 45			15426	CYANIDES
				CN 52			15427	"
				CN 32			15428	"
				CN 41			15431	"
				CN 47			15432	"
				CN-10			15429	"
<i>PRESERVED IN</i>				CN-26			15430	"
<i>NaOH TO pH > 12</i>				CN-1			15433	"
				CN-15			15434	"
				CN-24			15435	"
				CN-30			15436	"
				CN-2			15437	"
				CN-8			15438	"
				CN-5			15439	"
		↓		CN-14			15440	"

Relinquished by: *Charles R. Johnson*
Organization: WAR

Received by: *Walter Mock*
Organization: TSI

Date/Time
3/17/84 1330

Relinquished by:
Organization:

Received by:
Organization:

Date/Time

Relinquished by:
Organization:

Received by:
Organization:

Date/Time

Relinquished by:
Organization:

Received by:
Organization:

Date/Time

Relinquished by:
Organization:

Received for Laboratory by:

Date/Time

Method of Shipment: *DELIVERED*



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CHAIN OF CUSTODY RECORD

CLIENT: USAF		SAMPLERS: (Signature)					
PROJECT: ROBINS AFB							
Station Number	Station Location	Date	Time	Sample Type and No.		WAR Sample No.	Analysis Required
				Water	Air		
		3/15		CN-31		15456	CYANIDE
					S-3	15457	
				CN-39		15458	
				CN-25		15459	
				CN-17		15460	
				CN-22		15477	
				CN-21		15461	
PREERVED C				CN-28		15465	
NaOH TD pH >12				CN-3		15466	
				CN-19		15467	
				CN-7		15468	
				CN-44		15469	
				CN-48		15470	
				CN-23		15471	
		↓		CN-27		15473	V
Relinquished by:	Charles R. Bellon		Received by:	Walter Mack		Date/Time	
Organization:	WAR		Organization:	TSI		3/17/84	1335
Relinquished by:			Received by:			Date/Time	
Organization:			Organization:				
Relinquished by:			Received by:			Date/Time	
Organization:			Organization:				
Relinquished by:			Received by:			Date/Time	
Organization:			Organization:				
Relinquished by:			Received for Laboratory by:			Date/Time	
Organization:			Organization:				
Method of Shipment: CO. COURIER							



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Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: U.S.A.F.
PROJECT: ROBINS AFB

SAMPLERS: (Signature)

Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
				Water	Air	Sediment		
		3/15		CN-34			15441	CYANIDE
				CN-49			15442	"
				CN-12			15443	"
				CN-50			15444	"
				CN-11			15445	"
				CN-43			15446	"
				CN-29			15447	"
<i>PRESERVED C</i>				CN-37			15448	"
<i>NaOH TO pH >12</i>				CN-16			15449	"
				CN-4			15450	"
				CN-13			15451	"
				CN-46			15452	"
					S-1		15453	"
				CN-38			15454	"
					S-2		15455	"

Relinquished by: *Charles R. Fellows*
Organization: WAR

Received by: *Walter Mock*
Organization: TSI

Date/Time
3/17/84 1335

Relinquished by:
Organization:

Received by:
Organization:

Date/Time

Relinquished by:
Organization:

Received by:
Organization:

Date/Time

Relinquished by:
Organization:

Received by:
Organization:

Date/Time

Relinquished by:
Organization:

Received for Laboratory by:

Date/Time

Method of Shipment: CO. COURIER



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: USAF

PROJECT: ROBINS AFB

SAMPLERS: (Signature)

Method of Shipment: Co. COURIER



Water and Air Research, Inc.
6821 S.W. Archer Road
P.O. Box 1121
Gainesville, Florida 32602

CHAIN OF CUSTODY RECORD

CLIENT: USAF

PROJECT: Robins AFB

SAMPLERS: (Signature)

Station Number	Station Location	Date	Time	Sample Type and No.			WAR Sample No.	Analysis Required
				Water	Air	Sediment		
		P023		VOA Bottles x 4			15486	1/4 Prior Poll
		CP-9					"	Organics
		CP-10		1l Bot			"	i.e.,
		CP-11 ¹²					"	Base Neut.
		D-69		Gal			"	Acid Extrat.
		D-70		Bot			"	Pesticides
								Purgeables

**NOTE: FOR PARAMETERS WHOSE DETECTION LIMITS
ARE NOT SPECIFIED IN THE S.O.W., REFER
TO THOSE ENUMERATED IN THE S.D.W.A.
REGULATIONS.**

Relinquished by: *Charles R. Johnson*
Organization: *WAR*

Received by: *Walter Mock*
Organization: *TSF*

Date/Time
3/7/84 1335

Relinquished by:
Organization:

Received by:
Organization:

Date/Time

Relinquished by:
Organization:

Received by:
Organization:

Date/Time

Relinquished by:
Organization:

Received by:
Organization:

Date/Time

Relinquished by:
Organization:

Received for Laboratory by:

Date/Time

Method of Shipment: *CO. COURIER*

APPENDIX K
WELL LOGS FROM THE LANDFILL CLOSURE REPORT (LETCO, 1980)

AUGER BORING RECORD

E.V. 59.8	DEPTH FEET	DESCRIPTION	UNIF. S:1	PENETRATION RESISTANCE, "N" BLOWS PER FOOT						SAMP. FOR WELL DATA	REMARKS
				10	20	30	40	60	80		
	1.5	Firm brown silty fine to coarse SAND (Fill)	S:1								Methane gas readings (% total gas):
		Loose, saturated miscellaneous solid waste materials: paper, plastics, wood, etc.									40%
											75%
	13.0	Soft dark gray organic SILT with layers of PEAT	OH								Off Scale
	20.0	Auger boring terminated									Off Scale

DATE DRILLED 12/12/79
 DRILLING METHOD Auger
 DRILLED BY R. Alexander
 LOGGED BY R. Alexander
 CHECKED BY J. Absalon

WATER TABLE 24 HR
 WATER TABLE TIME OF BORING
 UNDISTURBED SAMPLE
 LABORATORY TEST LOCATION

BORING NUMBER A-1
 JOB NUMBER MII-9309
 PAGE 1
 CORE DATA:
 CORE RECOVERY, %
 ROCK QUALITY DESIGNATION, %
 LOSS OF DRILLING FLUID



AUGER BORING RECORD

IV. 9.4	DEPTH FEET	DESCRIPTION	UNIFIED SOIL TYPE	PENETRATION RESISTANCE, "N" BLOWS PER FOOT						SAMPLE TYPE OR WELL DATA	REMARKS
				10	20	30	40	60	80		
	2.0	Firm brown silty fine to coarse SAND (Fill)	SM								Methane gas readings (% total gas):
		Loose, saturated, miscellaneous solid waste materials: paper, plastics, wood, etc.									25%
											62%
13.5		Soft dark gray organic SILT with layers of PEAT	OH								Off Scale
20.0		Auger boring terminated									

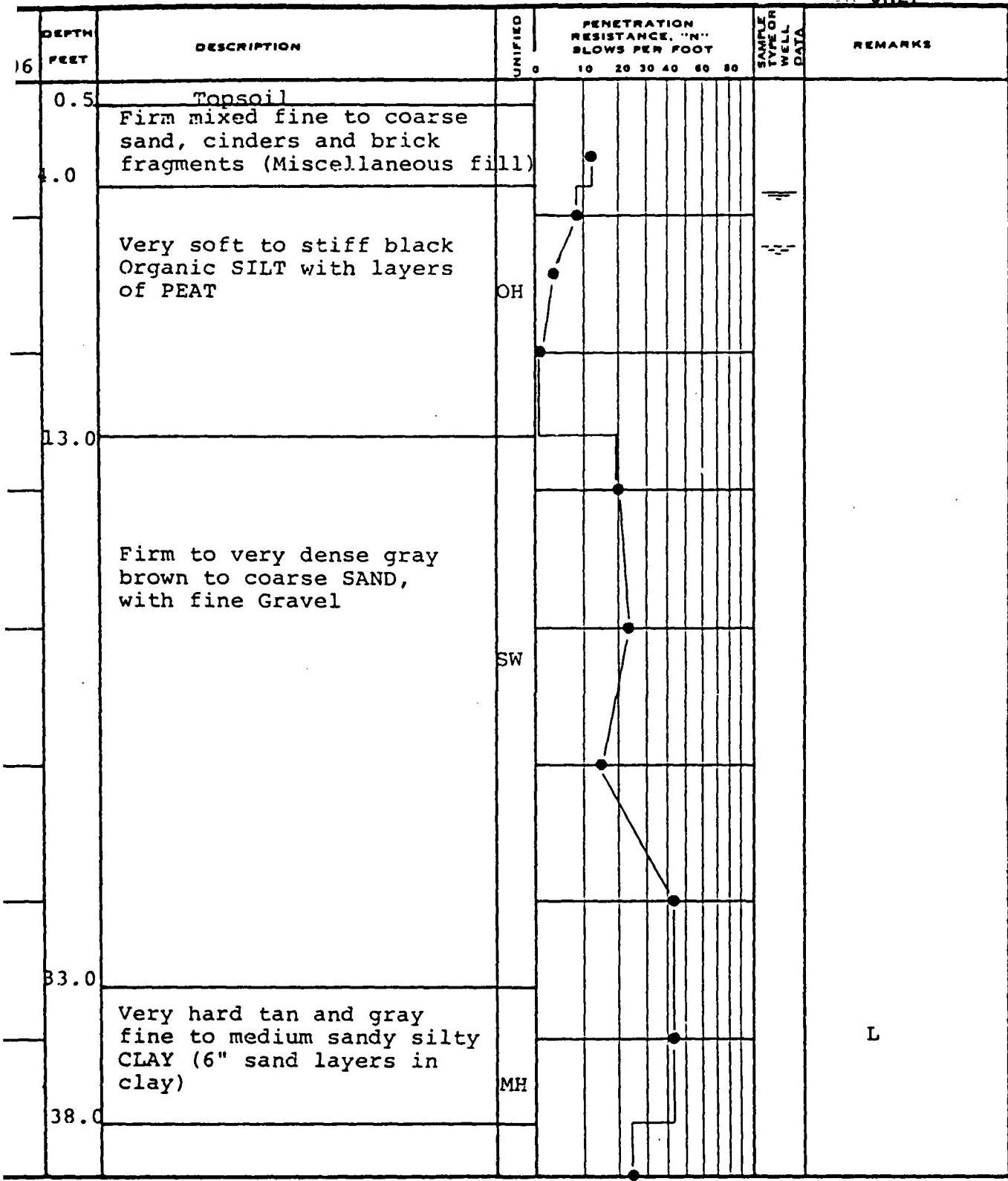
ATE DRILLED 12/12/79
 DRILLING METHOD Auger
 RILLED BY R. Alexander
 DGGED BY R. Alexander
 HECKED BY J. Absalon

WATER TABLE 24 HR
 WATER TABLE TIME OF BORING
 UNDISTURBED SAMPLE
 LABORATORY TEST LOCATION

BORING NUMBER A-2
 JOB NUMBER MH-9309
 PAGE 1
 CORE DATA:
 CORE RECOVERY, % XX REC
 ROCK QUALITY DESIGNATION, % XX RQD
 LOSS OF DRILLING FLUID |



AUGER BORING RECORD

DRILLED 12/11/79BORING METHOD RotaryILLED BY R. AlexanderIGNED BY R. AlexanderICKED BY J. Absalon

— WATER TABLE 24 HR
 ▨ WATER TABLE TIME OF BORING
 ■ UNDISTURBED SAMPLE
 L LABORATORY TEST LOCATION

BORING NUMBER W-1
JOB NUMBER MH 9309PAGE 1

CORE DATA:
 CORK RECOVERY, % REC
 ROCK QUALITY DESIGNATION, % RQD
 LOSS OF DRILLING FLUID



AUGER BORING RECORD

DEPTH FEET	DESCRIPTION	UNIFIED SOIL TYPE	PENETRATION RESISTANCE, "N" BLOWS PER FOOT								SAMPLE TYPE OR WELL DATA	REMARKS
			0	10	20	30	40	60	80			
60	Ground cover: sparse weeds	O										
	Soft dark gray Organic CLAY	OH										
3.0	Firm gray Clayey fine to coarse SAND	SC										
7.0	Firm gray slightly Clayey fine to coarse SAND	SP										
15.0	Auger boring terminated											Set 2" dia- meter PVC screen from 10.0 to 15.0 feet

TE DRILLED 12/19/79ILLING METHOD AugerILLED BY R. AlexanderGGED BY R. AlexanderECKED BY J. Absalon

WATER TABLE 24 HR

 WATER TABLE
TIME OF BORING

UNDISTURBED SAMPLE

 LABORATORY TEST
LOCATIONBORING NUMBER W-13JOB NUMBER MH-9309PAGE 1

CORE DATA:

CORE RECOVERY, %

ROCK QUALITY DESIGNATION, %

LOSS OF DRILLING FLUID

XX REC

XX RQD



AUGER BORING RECORD

IV. DEPTH FEET	DESCRIPTION	D UNIFIE D	PENETRATION RESISTANCE, "N" BLOWS PER FOOT						SAMPLE TYPE OR WELL DATA	REMARKS
			20	10	20	30	40	60	80	
1.57	Ground cover: sparse weeds	S								
	Firm brown silty firm to coarse SAND (Fill)	S'M								
4.0	Stiff brown fine to coarse Sandy CLAY	CL								
9.0	Firm brown clayey fine to coarse SAND	SC								Set 2" dia- meter PVC screen from 10.0 to 15.0 feet
15.0	Auger boring terminated									

DATE DRILLED 12/19/70
 DRILLING METHOD Auger

DRILLED BY R. Alexander
 LOGGED BY R. Alexander
 CHECKED BY J. Absalon

WATER TABLE 24 HR
 WATER TABLE TIME OF BORING
 UNDISTURBED SAMPLE
 LABORATORY TEST LOCATION

BORING NUMBER V-12
 JOB NUMBER MIH-9309
 PAGE 1

CORE DATA:
 CORE RECOVERY, % XX REC
 ROCK QUALITY DESIGNATION, % XX RQD
 LOSS OF DRILLING FLUID XX



AUGER BORING RECORD

E.V. FEET	DEPTH FEET	DESCRIPTION	UNIFAC CODE	PENETRATION RESISTANCE, "N" BLOWS PER FOOT						SAMPLE TYPE WELL DATA	REMARKS
				10	20	30	40	60	80		
2.50		Ground cover: none									
		Loose saturated miscellaneous solid waste materials.									
10.0		Soft dark gray PEAT and Organic SILT	OH								
13.0		Soft gray and brown fine to medium Sandy CLAY	CL								
20.0		Auger boring terminated									

Set 2" diameter PVC screen from 15.0 to 20.0 feet.

Field permeability determined
1/14-1/15/80
 $K = 6 \times 10^{-5}$
Cm/Sec

BATE DRILLED 12/17/79
DRILLING METHOD Auger
DRILLED BY R. Alexander
LOGGED BY R. Alexander
CHECKED BY J. Absalon

WATER TABLE 24 HR
WATER TABLE TIME OF BORING
UNDISTURBED SAMPLE
LABORATORY TEST LOCATION

BORING NUMBER 11-11
JOB NUMBER 1H-0309
PAGE 1
CORE DATA:
CORE RECOVERY, %
ROCK QUALITY DESIGNATION, %
LOSS OF DRILLING FLUID



AUGER BORING RECORD

DATE DRILLED 12/13/79

DRILLING METHOD Auger

PRINTED BY R. Alexander

Leased by R. Alexander

Signed by J. Absalon

~~WATER TABLE 24 HR~~

**WATER TABLE
TIME OF BORING**

WATERSTORAGE SAMPLES

**L LABORATORY TEST
LOCATION**

BORING NUMBER W-10

JOB NUMBER MH-9309

PAGE 1

CORE DATA:

CORE RECOVERY, % [xx] REC
ROCK QUALITY DESIGNATION, 3 [xx] RPD

LOSS OF DRILLING FLUID

K-14 LAW ENGINEERING TESTING COMPANY



ROTARY BORING RECORD

ELEV. 260.9	DEPTH FEET	DESCRIPTION	UNIFIED SOIL TYPE	PENETRATION RESISTANCE, "N" BLOWS PER FOOT						SAMPLE TYPE FOR WELL DATA	REMARKS
				10	20	30	40	60	80		
(est)	2.0	Firm brown clayey fine to medium SAND (fill)	SC								
	5.0	Loose, saturated miscellaneous solid waste materials									
	12.0	Loose gray and dark brown SILTY fine to medium SAND	SP								
	22.0	Stiff gray fine to coarse Sandy CLAY	CL								
	25.0	Dense gray and brown fine to coarse SAND, with fine Gravel	SP								Set 2" dia- meter PVC screen from 25.0 to 30.0 feet
	30.0	Boring Terminated									

DATE DRILLED 12/13/79
 DRILLING METHOD Rotary

DRILLED BY R. Alexander
 LOGGED BY R. Alexander
 CHECKED BY J. Absalon

WATER TABLE 24 HR

WATER TABLE
TIME OF BORING

UNDISTURBED SAMPLE

LABORATORY TEST
LOCATION

BORING NUMBER 7-9
 JOB NUMBER NH-9309

PAGE 1

CORE DATA:
 CORE RECOVERY, % REC
 ROCK QUALITY DESIGNATION, % RQD
 LOSS OF DRILLING FLUID



AUGER BORING RECORD

RATE DRILLER

2/13/79

DRILLING METHOD Auger

Reviewed by - R. Alexander

access to R. Alexander

Answer to Dr. Absalon

CHECKED BY

1

WATER TABLE 34 M

三

WATER TABLE

1

TIME OF BORING

1

UNDISTURBED SAMPLING

BORING NUMBER W-8

BORING NUMBER 11H-9309
JOB NUMBER

PAGE 1

CORE DATA:

PAGE 1

CAKE RECIPES

PAGE 1

ROCK QUALITY

PAGE 1

1033 of 881

PAGE 1

K-12 LAW ENGINEERING TESTING COMPANY



AUGER BORING RECORD

PATE DRILLED 12/18/79

DRILLING METHOD Rotary

RECORDED BY R. Alexander

R. Alexander

Lesson IV

~~WATER TABLE 24 HR~~

WATER TABLE
TIME OF BORING

TIME OF CORING

**L LABORATORY TEST
LOCATION**

BORING NUMBER W-7

JOB NUMBER MH 9309

PAGE 2

CORE DATA:

**CORE RECOVERY, %
ROCK QUALITY BES**

**ROCK QUALITY DESIGNATION.
LOSS OF DRILLING FLUID**

LOSS OF DATING RECORDS



BORING RECORD

ELEV. 252.94	DEPTH FEET	DESCRIPTION Ground Cover: None	D E P T H F O OT	PENETRATION RESISTANCE, "IN" BLOWS PER FOOT 10 20 30 40 60 80	U S E A T T E R E V E L O C I T Y W O D	REMARKS
	4.0	Decomposing miscellaneous waste materials				
	8.5	Very soft to firm organic SILT with layers of PEAT	OH			L
	19.0	Firm to dense gray and brown clayey silty fine coarse SAND, with fine Gravel.	SM-SC			L
	23.0	Stiff gray clayey silty fine to coarse SAND	CL			L
	28.0	Firm white fine to coarse SAND, trace fine Gravel	SW			
	35.0	Firm gray brown silty fine to coarse SAND	SM			L
	39.0	Dense white silty fine to medium SAND, trace mica SP	SP			
			SM			

DATE DRILLED 12/19/79DRILLING METHOD RotaryDRILLED BY R. AlexanderLOGGED BY R. AlexanderCHECKED BY J. AbsalonBORING NUMBER W-7
JOB NUMBER MH 9309PAGE 1

WATER TABLE 24 HR

WATER TABLE TIME OF BORING

UNDISTURBED SAMPLE

CORE DATA:

CORE RECOVERY, %

ROCK QUALITY DESIGNATION, %

LOSS OF DRILLING FLUID

XX REC

XX RQD

LABORATORY TEST LOCATION



AUGER BORING RECORD

ELEV. 253.14	DEPTH FEET	DESCRIPTION	UNIFED J-8	PENETRATION RESISTANCE, "N" BLOWS PER FOOT						SAMPLER TYPE OR WELL DATA	REMARKS
				10	20	30	40	60	80		
		Ground cover: none									
		Loose, saturated miscellaneous solid waste materials									
	4.0	Very soft to soft dark brown PEAT and dark gray organic SILT	OH								
	15.0	Auger boring terminated									

DATE DRILLED 12/13/79
 DRILLING METHOD Auger
 DRILLED BY R. Alexander
 LOGGED BY R. Alexander
 CHECKED BY J. Absalon

WATER TABLE 24 HR
 TOP TIME OF BORING
 UNDISTURBED SAMPLE
 LABORATORY TEST LOCATION

BORING NUMBER W-6
 JOB NUMBER NH-9300
 PAGE 1
 CORE DATA:
 CORE RECOVERY, % REC
 ROCK QUALITY DESIGNATION, % RQD
 LOSS OF DRILLING FLUID



AUGER BORING RECORD

DATE DRILLED 12/13/79
DRILLING METHOD Auger
DRILLED BY R. Alexander
LOGGED BY R. Alexander
CHECKED BY J. Absalon

**WATER TABLE 24 HR
WATER TABLE
TIME OF BORING
UNDISTURBED SAMPLE
LABORATORY TEST
LOCATION**

BORING NUMBER W-5
JOB NUMBER ME 9300

PAGE 1

PAGE 1

CORE DATA:

ROCK RECOVERY, %

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AUGER BORING RECORD

DATE DRILLED 12/13/79
DRILLING METHOD Auger
DRILLED BY R. Alexander
LOGGED BY R. Alexander
CHECKED BY J. Absalon

 WATER TABLE 24 HR
 WATER TABLE
 TIME OF BORING
 UNDISTURBED SAMPLE
 LABORATORY TEST
 LOCATION

BORING NUMBER W-4
JOB NUMBER MW 9300
PAGE 1

CORE DATA:
CORE RECOVERY, % XX%
ROCK QUALITY DESIGNATION, % XX%
LOSS OF DRILLING FLUID █ |

K-7 LAW ENGINEERING TESTING COMPANY



AUGER BORING RECORD

DATE DRILLED 12/13/79
DRILLING METHOD Auger
DRILLED BY R. Alexander
LOGGED BY R. Alexander
CHECKED BY J. Absalon

 WATER TABLE 24 HR
 WATER TABLE
TIME OF BORING
 UNDISTURBED SAMPLE
 LABORATORY TEST
LOCATION

BORING NUMBER	W-3
JOB NUMBER	MH 9309
CORE DATA:	PAGE 1
CORE RECOVERY, %	<input checked="" type="checkbox"/> REC
ROCK QUALITY DESIGNATION, %	<input checked="" type="checkbox"/> RQD
LOSS OF DRILLING FLUID	<input checked="" type="checkbox"/> LDF



AUGER BORING RECORD

ELEV. 254, 56	DEPTH FEET	DESCRIPTION Ground Cover: none	UNIFIED SOIL TYPE	PENETRATION RESISTANCE, "N" BLOWS PER FOOT						SAMPLE TYPE OR WELL DATA	REMARKS
				10	20	30	40	60	80		
		Loose saturated miscellaneous solid waste materials									
	12.0										
	14.0	Soft dark gray organic CLAY	OH								
	20.0	Auger boring terminated									

DATE DRILLED 12/17/79
 DRILLING METHOD Auger
 DRILLED BY R. Alexander
 LOGGED BY R. Alexander
 CHECKED BY J. Absalon

— WATER TABLE 24 HR
 - - - WATER TABLE TIME OF BORING
 ■ UNDISTURBED SAMPLE
 L LABORATORY TEST LOCATION

BORING NUMBER W-2
 JOB NUMBER MH 9309

PAGE 1
 CORE DATA:
 CORE RECOVERY, % REC
 ROCK QUALITY DESIGNATION, % RQD
 LOSS OF DRILLING FLUID



AUGER BORING RECORD

DATE DRILLED 12/11/70
DRILLING METHOD Rotary
DRILLED BY R. Alexander
LOGGED BY R. Alexander
CHECKED BY J. Absalon

WATER TABLE 24 HR
WATER TABLE
TIME OF BORING
UNDISTURBED SAMPLE
LABORATORY TEST
LOCATION

BORING NUMBER W-1
JOB NUMBER MH 9309
E DATA: PAGE 1
R RECOVERY, % XX
K QUALITY DESIGNATION, % XXX
S OF DRILLING TIME 1



AUGER BORING RECORD

DATE DRILLED 12/20/79
DRILLING METHOD Auger
DRILLED BY R. Alexander
LOGGED BY R. Alexander
CHECKED BY J. Absalon

 WATER TABLE 24 HR
 WATER TABLE
 TIME OF BORING
 UNDISTURBED SAMPLE
 LABORATORY TEST
 LOCATION

BORING NUMBER 11-14
JOB NUMBER MH-9309
PAGE 1
E DATA:
RECOVERY, % XX REC
QUALITY DESIGNATION, % XX REC
S OF DRILLING FLUID



AUGER BORING RECORD

ELEV. 249.94	DEPTH FEET	DESCRIPTION Ground cover: grass	SOLID CL	PENETRATION RESISTANCE, "N" BLOWS PER FOOT						SAMPLE TYPE OR CORE DATA	REMARKS
				0	10	20	30	40	60		
	0.5	Topsoil									
		Stiff gray brown fine to medium Sandy CLAY with fine Gravel (Fill)	CL								
	5.0	Soft dark gray fine to coarse Sandy Organic CLAY	OH								
	8.0	Very stiff gray brown fine to medium Sandy CLAY	CL								
	15.0	Auger boring terminated									

DATE DRILLED 2/27/80
 DRILLING METHOD Auger
 DRILLED BY H. Collins
 LOGGED BY H. Collins
 CHECKED BY J. Absalon

WATER TABLE 24 HR
 WATER TABLE TIME OF BORING
 UNDISTURBED SAMPLE
 LABORATORY TEST LOCATION

BORING NUMBER W-15
 JOB NUMBER MH-9309
 PAGE 1
 CORE DATA:
 CORE RECOVERY, % REC
 ROCK QUALITY DESIGNATION, % RQD
 LOSS OF DRILLING FLUID



AUGER BORING RECORD

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2/27/80

REVIEWING METAL

Auger

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H. Collins

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H. Collins

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J. Absalon

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WATER TABLE 34 MM

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WATER TABLE

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TIME OF BOTTLES

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LABORATORY TEST

BOILING NUMBER V-16

WORKING NUMBER W-1000

PAGE

FREE DATA

FREE RECOVERY

ROCK QUALITY DESIGNATION.

LOSS OF DRILLING FLUID

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AUGER BORING RECORD

DATE DRILLED 12/20/79
DRILLING METHOD Auger
DRILLED BY R. Alexander
LOGGED BY R. Alexander
CHECKED BY J. Absalon

**WATER TABLE 24 HR
WATER TABLE
TIME OF BORING
UNDISTURBED SAMPLE
LABORATORY TEST
LOCATION**

BORING NUMBER 17-17
JOB NUMBER 17-9309
PAGE 1
CORE DATA:
CORE RECOVERY, %
ROCK QUALITY DESIGNATION, 
LOSS OF DRILLING FLUID 



ROTARY BORING RECORD

ELEV. 250.10	DEPTH FEET	DESCRIPTION	SAMPLER TYPE SW	PENETRATION RESISTANCE, "N" BLOWS PER FOOT						CORE DATA	REMARKS
				5	10	20	30	40	60		
	0.5	Ground cover: grass Topsoil	SW								
	3.0	Loose gray brown fine to coarse SAND, with Gravel (Fill)	SC								
	8.0	Firm gray brown clayey fine to coarse SAND (Fill)	OH								
	12.0	Soft dark gray Organic CLAY	CL								
	21.0	Stiff gray fine sandy silty CLAY	CL								
	33.0	Loose light brown slightly clayey fine to medium SAND	SP								
	40.0	Firm gray pink and brown slightly Clayey fine to coarse SAND	SP								
		Boring terminated									Set 2" diameter PVC screen from 35.0 to 40.0 feet

DATE DRILLED 2/28/80
DRILLING METHOD Rotary
DRILLED BY H. Collins
LOGGED BY H. Collins
CHECKED BY J. Absalon

WATER TABLE 24 HR
WATER TABLE TIME OF BORING
UNDISTURBED SAMPLE
L LABORATORY TEST LOCATION

BORING NUMBER V-18
JOB NUMBER MH-9309

PAGE 1
CORE DATA:
CORE RECOVERY, % XX REC
ROCK QUALITY DESIGNATION, % XX RQD
LOSS OF DRILLING FLUID XX



ROTARY BORING RECORD

ELEV. 248.50	DEPTH FEET	DESCRIPTION Ground cover: Grass	UNIFIED SC	PENETRATION RESISTANCE, "N" BLOWS PER FOOT 0 10 20 30 40 60 80	SAMPLE TYPE OR CORE DATA	REMARKS
	0.5	<u>Topsoil</u> Loose to firm gray brown Clayey fine to coarse SAND, with Gravel (Fill)				
	7.0	 Soft dark gray Organic CLAY OH				
	11.0	 Loose gray brown slightly Clayey fine to medium SAND SP				
	25.0	 Auger boring terminated				Set 2" dia- meter PVC screen from 20.0 to 25.0 feet

DATE DRILLED 2/27/80

DRILLING METHOD Auger

RECORDED BY H. Collins

Lessons by H. Collins

SEARCHED BY J. Absalon

~~_____~~ WATER TABLE 24 HR

**WATER TABLE
TIME OF BORING**

UNPREDICTED SAMPLE

**LABORATORY TEST
LOCATION**

BORING NUMBER W-9

BORING NUMBER _____
JOB NUMBER MH-9309

PAGE 1

CORE DATA:

CORE RECOVERY, %	XX REC
ROCK QUALITY DESIGNATION, %	XX RQD
LOSS OF DRILLING FLUID	█

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APPENDIX L

**RESULTS OF CYANIDE, PURGEABLE ORGANICS, AND
Pesticides Analyses, Robins AFB, Georgia, December 1983**

Table L-1. Results of Analyses of Environmental Samples Collected in the Vicinity of Landfill 4 and the Sludge Lagoon (Zone 1), Robins AFB, Georgia, December 1983

Station No.	Matrix	Cyanide (ug/l)
LF4-1	GW	<20
LF4-2	GW	<20
LF4-3	GW	<20
LF4-4	GW	295
LF4-5	GW	<20
LF4-6	GW	345
LF4-7	GW	25
LF4-8	GW	<20
LF4-9	GW	<20
LF4-10	GW	<20
LF4-11	GW	<20
LF4-12	GW	<20
LF4-13	GW	<20
LF4-14	SW	95
LF4-14	SED	59,800*
LF4-15	SW	<20
LF4-15	SED	104,000*
LF4-16	SW	<20
LF4-16	SED	6,130*
LF4-17	SW	<20
W-7	GW	<20
W-8	GW	<20
W-15	GW	<20
W-18	GW	<20
LCH Composite (LF4-22,23,24)		NA

*These data are given as ug/kg, dry weight.

GW = Groundwater.

SED = Sediment.

LCH = Leachate.

NA = Not analyzed.

SW = Surface water.

Table L-2. Purgeable Organics Concentrations in Samples Collected in the Vicinity of Landfill 4 and the Sludge Lagoon (Zone 1), Robins AFB, Georgia, December 1983 (Page 1 of 2)

Parameter	LF4-4	LF4-6	SW LF4-16	SED LF4-16
Volatile Halocarbons-All Units ug/l				
Bromodichloromethane	<1	<10	<1	<1
Bromoform	<1	<10	<1	<1
Bromomethane	<1	<10	<1	<1
Carbon tetrachloride	<1	<10	<1	1
Chlorobenzene	7	145	<1	<1
Chloroethane	<1	<10	<1	<1
2-Chloroethylvinyl ether	<1	<10	<1	<1
Chloroform	<1	<10	<1	<1
Chloromethane	<1	<10	<1	<1
Dibromochloromethane	<1	<10	<1	<1
1,2-Dichlorobenzene	7	3,560	<1	<1
1,3-Dichlorobenzene	<1	135	<1	<1
1,4-Dichlorobenzene	8	2,230	1	<1
Dichlorodifluoromethane	915	470	<1	<1
1,1-Dichloroethane	38	18	<1	<1
1,2-Dichloroethane	<1	51	<1	<1
1,1-Dichloroethene	4	2	<1	<1
Trans-1,2-Dichloroethene	325	18,900	<1	<1
1,2-Dichloropropane	<1	<10	<1	<1
Cis-1,3-Dichloropropene	<1	<10	<1	<1
Trans-1,3-Dichloropropene	<1	<10	<1	<1
Methylene chloride	3	650	<1	<1
1,1,2,2-Tetrachloroethane	<1	<100	<1	<1
Tetrachloroethene	<1	305	<1	<1
1,1,1-Trichloroethane	2	125	<1	<1
1,1,2-Trichloroethane	<1	<10	<1	<1
Trichloroethene	61	65,800	<1	<1
Trichlorofluoromethane	<1	390	<1	<1
Vinyl chloride	<1	<10	<1	<1
Volatile Aromatics-All Units ug/l				
Benzene	10	<10	<1	<1
Ethyl benzene	<1	18	<1	<1
Toluene	12	330	2	15
Xylenes	3	150	<1	<1

SW = Surface water.

SED = Sediment.

Table L-2. Purgeable Organics Concentrations in Samples Collected
in the Vicinity of Landfill 4 and the Sludge Lagoon (Zone 1),
Robins AFB, Georgia, December 1983 (Page 2 of 2)

Parameter	LF4-4	LF4-6	SW LF4-16	SED LF+16
<u>Volatile Halocarbons-All Units ug/l</u>				
Bromodichloromethane	<1	<1	<1	<1
Bromoform	<1	<1	<1	<1
Bromomethane	<1	3	3	<1
Carbon tetrachloride	<1	<1	12	<1
Chlorobenzene	<1	<1	<1	<1
Chloroethane	<1	<1	<1	<1
2-Chloroethylvinyl ether	<1	<1	<1	<1
Chloroform	1	<1	20	<1
Chloromethane	<1	<1	<1	<1
Dibromochloromethane	<1	<1	<1	<1
1,2-Dichlorobenzene	<1	<1	<1	<1
1,3-Dichlorobenzene	<1	<1	<1	<1
1,4-Dichlorobenzene	<1	<1	<1	<1
Dichlorodifluoromethane	<1	<1	<1	<1
1,1-Dichloroethane	<1	<1	<1	<1
1,2-Dichloroethane	<1	<1	<1	<1
1,1-Dichloroethene	<1	<1	4	<1
Trans-1,2-Dichloroethene	<1	<1	17	4
1,2-Dichloropropane	<1	<1	<1	<1
Cis-1,3-Dichloropropene	<1	<1	<1	<1
Trans-1,3-Dichloropropene	<1	<1	<1	<1
Methylene chloride	<5	5	68	<1
1,1,2,2-Tetrachloroethane	<1	<1	<1	<1
Tetrachloroethene	<1	3	2	<1
1,1,1-Trichloroethane	2	<1	14	<1
1,1,2-Trichloroethane	<1	<1	<1	<1
Trichloroethene	12	26	180	<1
Trichlorofluoromethane	<1	<1	<1	<1
Vinyl chloride	<1	<1	<1	<1
<u>Volatile Aromatics-All Units ug/l</u>				
Benzene	1	<1	5	<1
Ethyl benzene	<1	<1	<1	<1
Toluene	<1	<1	<1	4
Xylenes	<1	4	<1	<1

**Table L-3. Pesticide Concentrations in Samples Collected at Landfill 4
and the Sludge Lagoon (Zone 1), Robins AFB, Georgia,
December 1983**

Parameter	SW LF4-16 15235 ug/l	SED LF4-16* 15236 ug/kg	LCH 15242 ug/l	Composite
Aldrin	<0.02	<1	<0.02	
DDT-R†	<0.02	76.0	<0.02	
Dieldrin	<0.02	<2	<0.02	
Endrin	<0.02	<2	<0.02	
Heptachlor	<0.02	<1	<0.02	
Heptachlor Epoxide	<0.02	<1	<0.02	
Lindane	<0.01	<1	<0.01	
Methoxychlor	<0.20	<2	<0.20	
Chlordane	<0.02	109	<0.02	
Diazinon	NA	NA	NA	
Malathion	NA	NA	NA	
Parathion	NA	NA	NA	
2,4-D	NA	NA	NA	
2,4,5-T	NA	NA	NA	
Silvex	NA	NA	NA	

*Data given in ug/kg, dry weight.

†Less than values are for each isomer. Detectable quantities are reported as sum of all isomers.

SW = Surface water.

SED = Sediment.

LCH = Leachate.

NA = Not analyzed.

Table L-4. Results of Analyses of Environmental Samples Collected in the Vicinity of the DDT Spill Site (Zone 2), Robins AFB, Georgia, December 1983

Parameter	DDT-1	DDT-S1*	DDT-S2*	DDT-S3*	DDT-S4*
Matrix	GW	Soil	Soil	Soil	Soil
pH	4.8	NA	NA	NA	NA
Sp. Cond.					
@ 25°C (umhos/cm)	62	NA	NA	NA	NA
Aldrin	<0.02	<2.0	<200	<200	<400
Dieldrin	<0.02	<10	<100	<100	<200
Endrin	0.03	<10	<100	<100	<200
Heptachlor	<0.02	<10	<100	<100	<200
Heptachlor epoxide	<0.02	<10	<100	<100	<200
Lindane	0.22	<2.0	<20	<20	<40
Methoxychlor	<0.20	<20	<200	<200	<400
Chlordane	<0.02	773	77,000	19,400	52,000
DDT-R†	<0.02	199	22,800	20,800	186,000

*These data are given in ug/kg. All other units for pesticides are ug/l.

†Less than values are for each isomer. Detectable quantities are reported as sum of all isomers.

GW = Groundwater.

NA = Not analyzed.

Table L-5. Results of Purgeable Organics and Cyanide Analyses of Samples Collected in the Vicinity of the Fire Protection Training Area No. 2 (Zone 3), Robins AFB, Georgia, December 1983

Parameter	FPT 2-1	FPT 2-2	WS-12
Cyanide (ug/l)	NA	NA	<20
<u>Volatile Halocarbons-All Units ug/l</u>			
Bromodichloromethane	<100	<1	<1
Bromoform	<100	<1	<1
Bromomethane	<100	<1	<1
Carbon tetrachloride	<100	<1	<1
Chlorobenzene	2,690	<1	<1
Chloroethane	<100	<1	<1
2-Chloroethylvinyl ether	<100	<1	<1
Chloroform	<100	<1	1
Chloromethane	<100	<1	<1
Dibromochloromethane	<100	<1	<1
1,2-Dichlorobenzene	<100	<1	<1
1,3-Dichlorobenzene	<100	<1	<1
1,4-Dichlorobenzene	<100	<1	<1
Dichlorodifluoromethane	<100	<1	<1
1,1-Dichloroethane	<100	<1	<1
1,2-Dichloroethane	<100	<1	<1
1,1-Dichloroethene	<100	<1	<1
Trans-1,2-Dichloroethene	<100	<1	<1
1,2-Dichloropropane	<100	<1	<1
Cis-1,3-Dichloropropene	<100	<1	<1
Trans-1,3-Dichloropropene	<100	<1	<1
Methylene chloride	1,080	<1	<1
1,1,2,2-Tetrachloroethane	<100	<1	<1
Tetrachloroethene	<100	<1	<5
1,1,1-Trichloroethane	<100	<1	<1
1,1,2-Trichloroethane	<100	<1	<1
Trichloroethene	<100	<1	<1
Trichlorofluoromethane	<100	<1	<1
Vinyl chloride	<100	<1	<1
<u>Volatile Aromatics-All Units ug/l</u>			
Benzene	745	<1	1
Ethyl benzene	445	<1	<1
Toluene	2,700	<1	2
Xylenes	3,380	<1	1

NA = Not analyzed.

Table L-6. Purgeable Organics and Cyanide Concentrations in Samples Collected in the Vicinity of Landfill 1 (Zone 4),
Robins AFB, Georgia, December 1983

Parameter	LF1-1	LF1-2	LF1-3	LF1-4	LF1-5
Cyanide (ug/l)	<20	<20	130	<20	<20
<u>Volatile Halocarbons-All Units ug/l</u>					
Bromodichloromethane	NA	<1	<10	NA	NA
Bromoform	NA	<1	<10	NA	NA
Bromomethane	NA	<1	<10	NA	NA
Carbon tetrachloride	NA	<1	<10	NA	NA
Chlorobenzene	NA	<1	<10	NA	NA
Chloroethane	NA	3	<10	NA	NA
2-Chloroethylvinyl ether	NA	<1	<10	NA	NA
Chloroform	NA	<1	<10	NA	NA
Chloromethane	NA	<1	<10	NA	NA
Dibromochloromethane	NA	<1	<10	NA	NA
1,2-Dichlorobenzene	NA	<1	86	NA	NA
1,3-Dichlorobenzene	NA	<1	10	NA	NA
1,4-Dichlorobenzene	NA	<1	54	NA	NA
Dichlorodifluoromethane	NA	<1	<10	NA	NA
1,1-Dichloroethane	NA	<1	<10	NA	NA
1,2-Dichloroethane	NA	<1	<10	NA	NA
1,1,-Dichloroethene	NA	<1	<10	NA	NA
Trans-1,2-Dichloroethene	NA	<1	155	NA	NA
1,2-Dichloropropane	NA	<1	<10	NA	NA
Cis-1,3-Dichloropropene	NA	<1	<10	NA	NA
Trans-1,3-Dichloropropene	NA	<1	<10	NA	NA
Methylene chloride	NA	<5	150	NA	NA
1,1,2,2-Tetrachloroethane	NA	<1	<10	NA	NA
Tetrachloroethene	NA	6	<10	NA	NA
1,1,1-Trichloroethane	NA	<1	<10	NA	NA
1,1,2-Trichloroethane	NA	<1	<10	NA	NA
Trichloroethene	NA	35	16	NA	NA
Trichlorofluoromethane	NA	<1	<10	NA	NA
Vinyl chloride	NA	<1	<10	NA	NA
<u>Volatile Aromatics-All Units ug/l</u>					
Benzene	NA	<1	7,140	NA	NA
Ethyl benzene	NA	<1	365	NA	NA
Toluene	NA	2	9,320	NA	NA
Xylenes	NA	<1	9,260	NA	NA

NA = Not analyzed.

Table L-7. Purgeable Organics and Cyanide Concentrations in Samples Collected in the Vicinity of Landfill 2 (Zone 5), Robins AFB, Georgia, December 1983

Parameter	LF2-1	LF2-2	LF2-3	SW LF2-4	SW LF2-5	SW LF2-6
Cyanide (ug/l)	<20	25	<20	<20	<20	<20
<u>Volatile Halocarbons-All Units ug/l</u>						
Bromodichloromethane	<1	<1	<1	<1	<1	<1
Bromoform	<1	<1	<1	<1	<1	4
Bromomethane	<1	1	<1	<1	<1	<1
Carbon tetrachloride	<1	<1	2	<1	<1	2
Chlorobenzene	28	<1	<1	<1	<1	<1
Chloroethane	<1	1	<1	<1	<1	<1
2-Chloroethylvinyl ether	<1	<1	<1	<1	<1	<1
Chloroform	<1	2	<1	2	<1	11
Chloromethane	<1	<1	<1	<1	<1	<1
Dibromochloromethane	<1	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	74	<1	<1	81	<1	<1
1,3-Dichlorobenzene	7	<1	<1	3	<1	10
1,4-Dichlorobenzene	19	<1	<1	<1	<1	<1
Dichlorodifluoromethane	62	<1	<1	7	<1	12
1,1-Dichloroethane	<1	<1	<1	<1	<1	<1
1,2-Dichloroethane	3	<1	<1	1	<1	5
1,1-Dichloroethene	1	<1	<1	<1	<1	2
Trans-1,2-Dichloroethene	240	85	62	42	<1	295
1,2-Dichloropropane	<1	<1	<1	<1	<1	<1
Cis-1,3-Dichloropropene	<1	<1	<1	<1	<1	<1
Trans-1,3-Dichloropropene	<1	<1	<1	<1	<1	<1
Methylene chloride	<1	<1	<1	<1	<1	4
1,1,2,2-Tetrachloroethane	<1	<1	<1	<1	<1	<1
Tetrachloroethene	23	44	20	15	<1	72
1,1,1-Trichloroethane	2	2	1	2	2	<1
1,1,2-Trichloroethane	<1	<1	<1	<1	<1	<1
Trichloroethene	185	20	14	185	<1	1,510
Trichlorofluoromethane	<1	<1	<1	<1	<1	<1
Vinyl chloride	<1	<1	<1	<1	<1	<1
<u>Volatile Aromatics- All Units ug/l</u>						
Benzene	6	<1	4	<1	<1	<1
Ethyl benzene	<1	<1	<1	<1	<1	<1
Toluene	<1	<1	<1	<1	<1	<1
Xylenes	<1	<1	<1	<1	<1	<1

SW = Surface water.

Table L-8. Results of Analyses of Environmental Samples Collected in the Vicinity of the Hazardous Waste Burial Site (Zone 6), Robins AFB, Georgia, December 1983

Station No.	Matrix	DDT (ug/l)	PCB (ug/l)
HW-1	GW	0.05	<0.2

GW = Groundwater.

Table L-9. Purgeable Organics and Cyanide Concentrations in Samples Collected from Water Supply Wells WS-3, WS-6, and WS-8, Robins AFB, Georgia, December 1983

Parameter	WS-3	WS-6	WS-8
Cyanide (ug/l)	<20	<20	<20
Volatile Halocarbons-All Units ug/l			
Bromodichloromethane	<1	7	3
Bromoform	<1	<1	<1
Bromomethane	<1	<1	<1
Carbon tetrachloride	<1	1	<1
Chlorobenzene	<1	<1	<1
Chloroethane	<1	<1	<1
2-Chloroethylvinyl ether	<1	<1	<1
Chloroform	<1	3	5
Chloromethane	<1	<1	<1
Dibromochloromethane	<1	3	1
1,2-Dichlorobenzene	2	<1	<1
1,3-Dichlorobenzene	1	7	1
1,4-Dichlorobenzene	2	<1	<1
Dichlorodifluoromethane	<1	<1	<1
1,1-Dichloroethane	<1	<1	<1
1,2-Dichloroethane	<1	<1	<1
1,1-Dichloroethene	<1	<1	<1
Trans-1,2-Dichloroethene	<1	<1	<1
1,2-Dichloropropane	<1	<1	<1
Cis-1,3-Dichloropropene	<1	<1	<1
Trans-1,3-Dichloropropene	<1	<1	<1
Methylene chloride	<1	24	1
1,1,2,2-Tetrachloroethane	<1	<1	<1
Tetrachloroethene	2	<1	<1
1,1,1-Trichloroethane	2	<1	<1
1,1,2-Trichloroethane	<1	<1	<1
Trichloroethene	6	1	<1
Trichlorofluoromethane	<1	<1	<1
Vinyl chloride	<1	<1	<1
Volatile Aromatics-All Units ug/l			
Benzene	<1	1	<1
Ethyl benzene	<1	<1	<1
Toluene	<1	<1	<1
Xylenes	<1	<1	<1

Table L-10. Results of Analyses of Composite Sample of Water Supply
 Wells WS-3, WS-6, and WS-8, Robins AFB, Georgia,
 December 1983 (Page 1 of 4)

Parameter	December 1983
<u>Volatile Organics (ug/l)</u>	
Acrolein	<100
Acrylonitrile	<100
Benzene	<10
Bromodichloromethane	<10
Bromoform	<10
Bromomethane	<10
Carbon tetrachloride	<10
Chlorobenzene	<10
Chloroethane	<10
2-Chloroethylvinyl ether	<10
Chloroform	<10
Chloromethane	<10
Dibromochloromethane	<10
1,1-Dichloroethane	<10
1,2-Dichloroethane	<10
1,1-Dichloroethene	<10
Trans-1,2-Dichloroethene	<10
1,2-Dichloropropane	<10
Cis-1,3-Dichloropropene	<10
Trans-1,3-Dichloropropene	<10
Methylene chloride	<10
1,1,2,2-Tetrachloroethane	<10
Tetrachloroethene	<10
1,1,1-Trichloroethane	<10
1,1,2-Trichloroethane	<10
Trichloroethene	<10
Trichlorofluoromethane	<10
Vinyl chloride	<10
Ethyl benzene	<10
Toluene	<10

Table L-10. Results of Analyses of Composite Sample of Water Supply
 Wells WS-3, WS-6, and WS-8, Robins AFB, Georgia,
 December 1983 (Page 2 of 4)

Parameter	December 1983
<u>Pesticides/PCBs (ug/l)</u>	
Aldrin	<10
Alpha-BHC	<10
Beta-BHC	<10
Gamma-BHC	<10
Delta-BHC	<10
Chlordane	<10
4,4'-DDT	<10
4,4'-DDE	<10
4,4'-DDD	<10
Dieldrin	<10
Alpha-Endosulfan	<10
Beta-Endosulfan	<10
Endosulfan sulfate	<10
Endrin	<10
Endrin aldehyde	<10
Heptachlor	<10
Heptachlor epoxide	<10
PCB-1242	<10
PCB-1254	<10
PCB-1221	<10
PCB-1232	<10
PCB-1248	<10
PCB-1260	<10
PCB-1016	<10
Toxaphene	<10
<u>Phenolics (ug/l)</u>	
Phenol	<25
2-Chlorophenol	<25
2-Nitrophenol	<25
2,4-Dimethylphenol	<25
2,4-Dichlorophenol	<25
p-Chloro-m-cresol	<25
2,4,6-Trichlorophenol	<25
2,4-Dinitrophenol	<250
4-Nitrophenol	<25
4,6-Dinitro-o-cresol	<250
Pentachlorophenol	<25

Table L-10. Results of Analyses of Composite Sample of Water Supply
 Wells WS-3, WS-6, and WS-8, Robins AFB, Georgia,
 December 1983 (Page 3 of 4)

Parameter	December 1983
<u>Base/Neutrals (ug/l)</u>	
N-nitrosodimethylamine	<10
bis (2-Chloroethyl) Ether	<10
1,3-Dichlorobenzene	<10
1,4-Dichlorobenzene	<10
1,2-Dichlorobenzene	<10
bis (2-Chloroisopropyl) ether	<10
Hexachloroethane	<10
N-nitrosodi-n-propylamine	<10
Nitrobenzene	<10
Isophorone	<10
bis (2-Chloroethoxy) methane	<10
1,2,4-Trichlorobenzene	<10
Naphthalene	<10
Hexachlorobutadiene	<10
Hexachlorocyclopentadiene	<10
2-Chloronaphthalene	<10
Dimethylphthalate	<10
Acenaphthylene	<10
2,6-Dinitrotoluene	<10
Acenaphthene	<10
2,4-Dinitrotoluene	<10
Diethylphthalate	<10
Fluorene	<10
4-Chlorophenyl phenyl ether	<10
Diphenylamine (N-nitroso)	<10
1,2-Diphenylhydrazine (Azobenzene)	<10
4-Bromophenyl phenyl ether	<10
Hexachlorobenzene	<10
Phenanthrene	<10
Anthracene	<10
Di-n-butylphthalate	<10
Fluoranthene	<10
Benzidine	<10
Pyrene	<10
Butylbenzylphthalate	<10
Benzo(a)anthracene	<10

**Table L-10. Results of Analyses of Composite Sample of Water Supply
Wells WS-3, WS-6, and WS-8, Robins AFB, Georgia,
December 1983 (Page 4 of 4)**

Parameter	December 1983
<u>Base/Neutrals (ug/l)</u>	
3,3-Dichlorobenzidine	<10
Chrysene	<10
bis (2-Ethylhexyl) phthalate	<10
Di-n-octylphthalate	<10
Benzo (b) fluoranthene	<10
Benzo (k) fluoranthene	<10
Benzo (a) pyrene	<10
Indeno (1,2,3-c,d) pyrene	<25
Dibenzo (a,h) anthracene	<25
Benzo (g,h,i) perylene	<25

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